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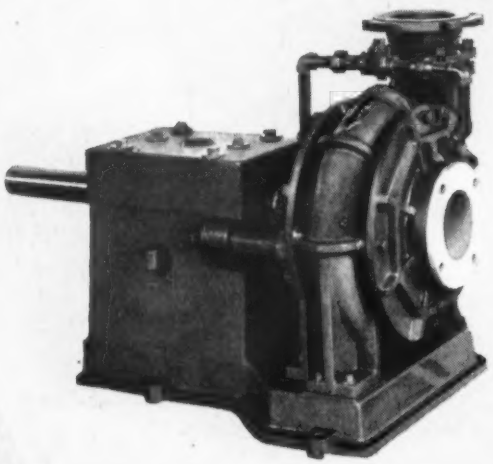

The Franklin Institute of the State of Pennsylvania was founded in 1824 and is the oldest institution in the United States for the Advancement of Science and the Promotion of the Mechanic Arts. Annually, since 1890 the Institute has awarded the Edward Longstreth Medal of Merit for Invention. The list of inventors and inventions so honored contains many world-famous names which you would instantly recognize . . . This year the award was bestowed for the invention of Hydroseal. The actual citation from the Institute reads as follows: "In consideration of the development of a pump (Hydroseal) which will successfully handle water or liquids, containing abrasive materials, retain its initial efficiency and original discharge for considerable periods, with low maintenance costs and the successful manufacture of this type of pump (Hydroseal) giving satisfactory operation in many installations" . . . If you'd like to know more about the Hydroseal Pump, write for Catalog No. 140.

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POWER (with which are consolidated "Science and Industry," "The Engineer Review," "The Engineer," and "The Stationary Engineer"), June, 1944, Vol. 88, No. 6. Published monthly with an additional Directory number in December. McGraw-Hill Publishing Company, Inc. Publication office, 99-129 North Broadway, Albany 1, N. Y. Editorial and Executive Offices, 330 West 42nd Street, New York 18, N. Y. Entered as second class matter, August 25, 1936, at Albany, N. Y., under the act of March 3, 1879. Printed in U. S. A. Allow at least ten days for change of address. All communications about subscriptions should be addressed to the Director of Circulation, Power, 330 West 42nd Street, New York 18, N. Y. Subscription rates—U. S. and U. S. Possessions, $3.00 for one year, $4.00 for two years. Canada, $3.50 for one year, $5.00 for two years. Great Britain and British Possessions, 36 shillings per year. All other countries, $6.00 for one year, $9.00 for two years. Single copies 25 cents.

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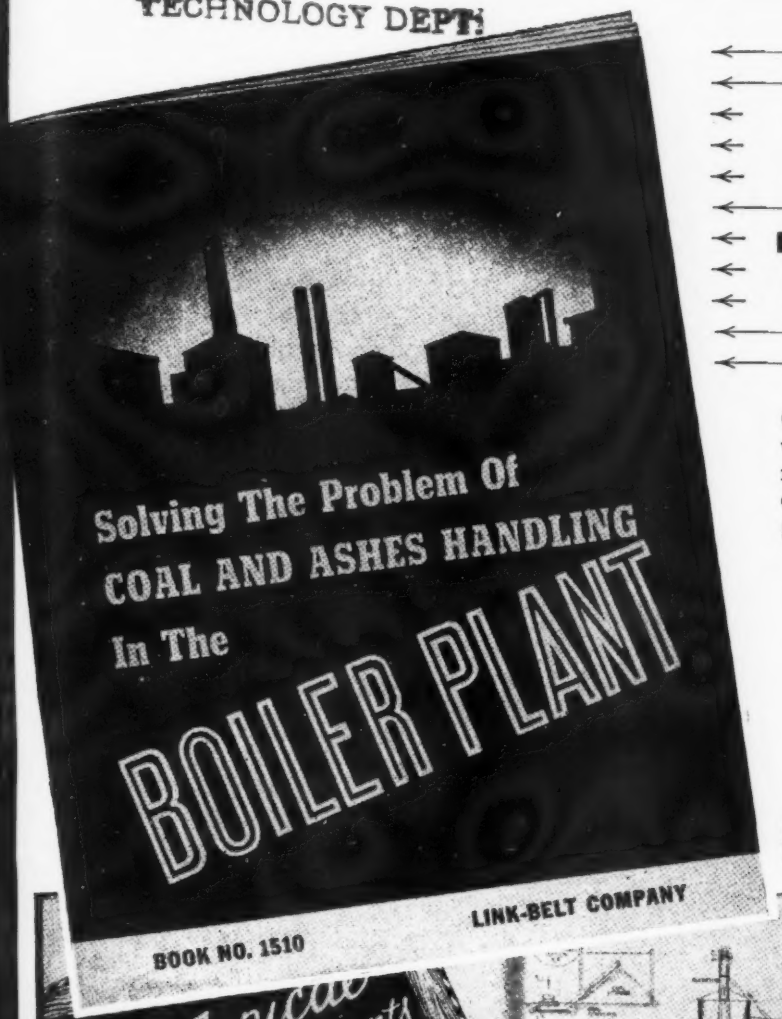

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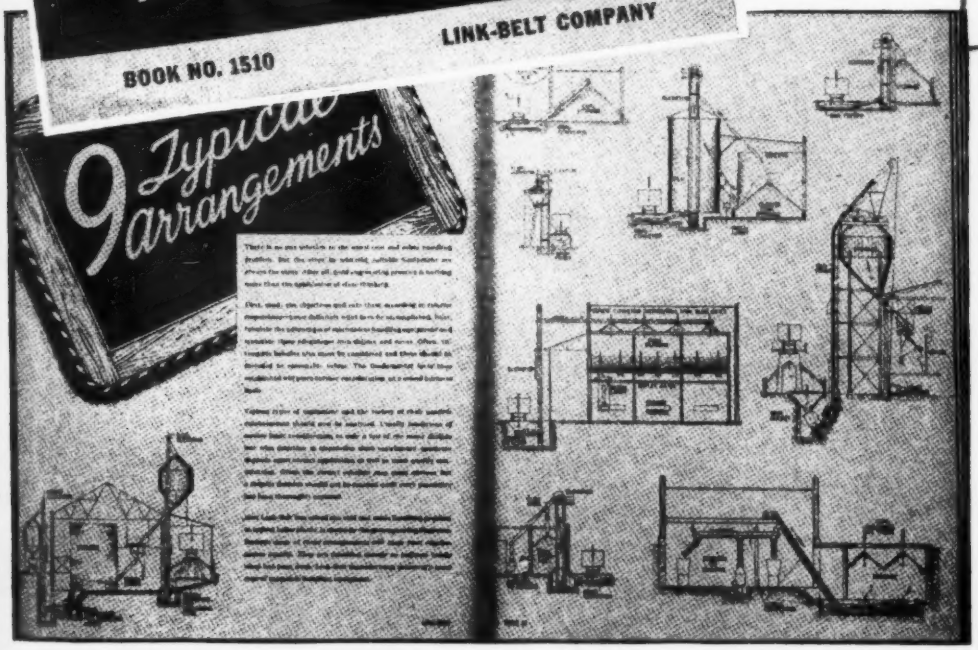

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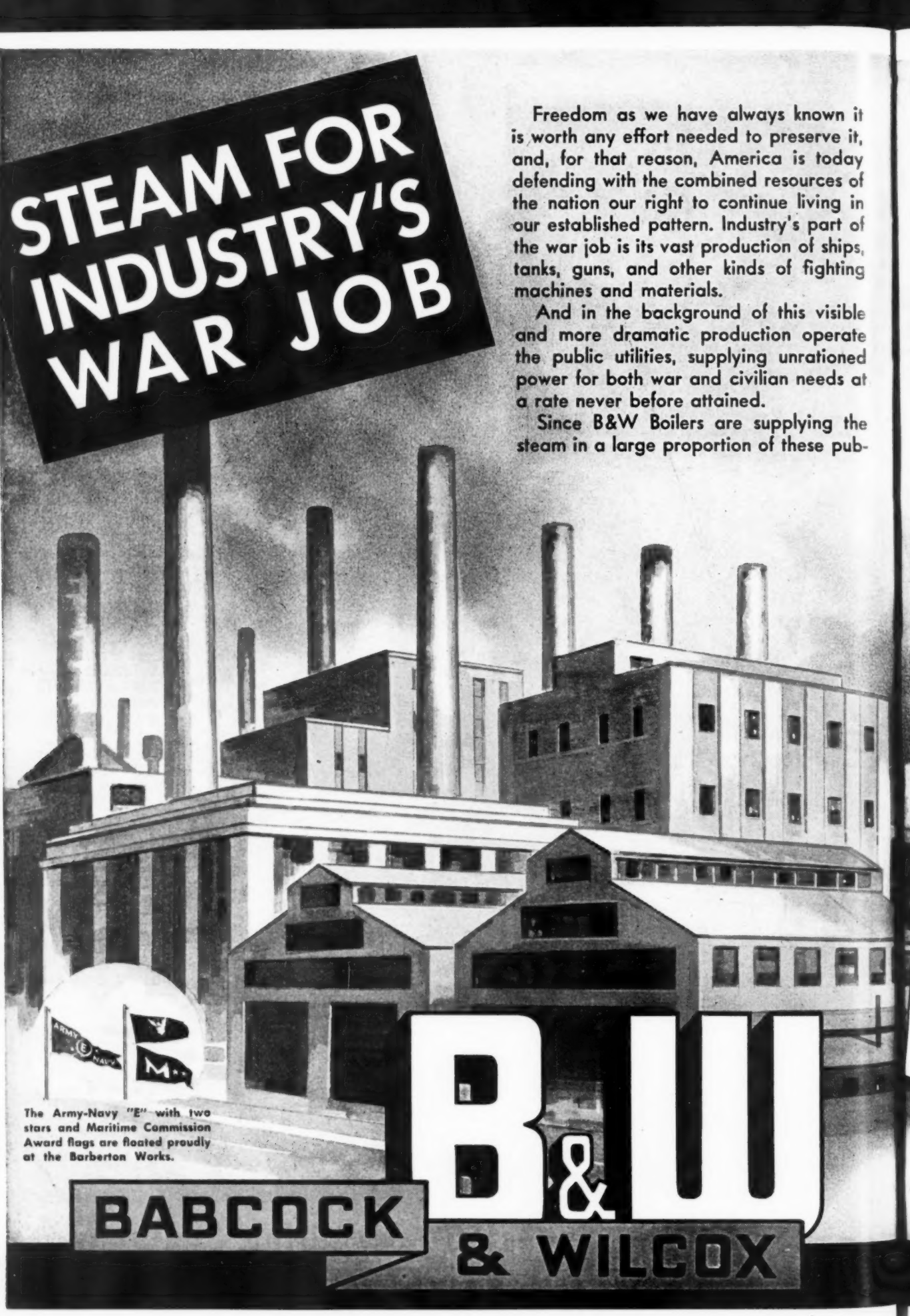

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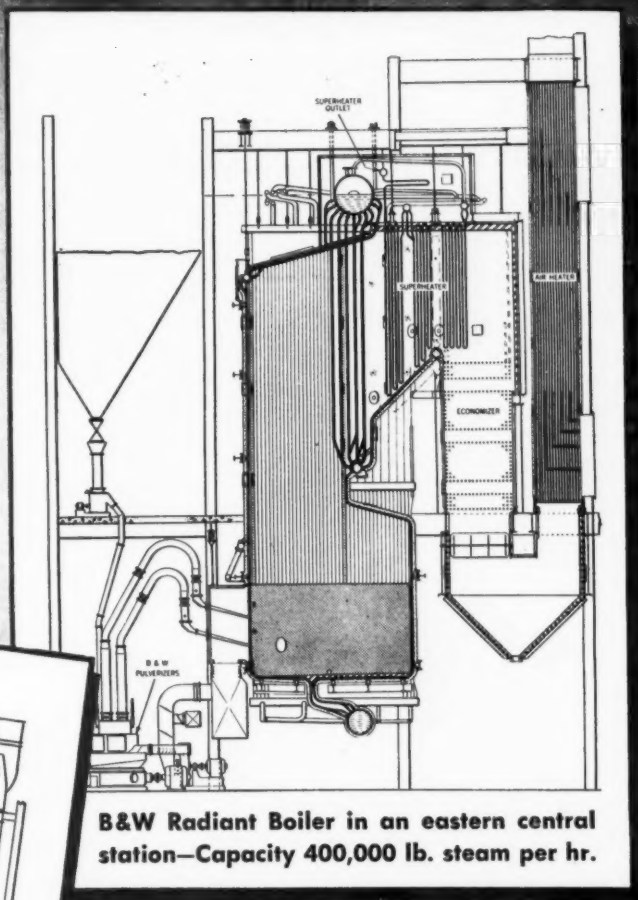

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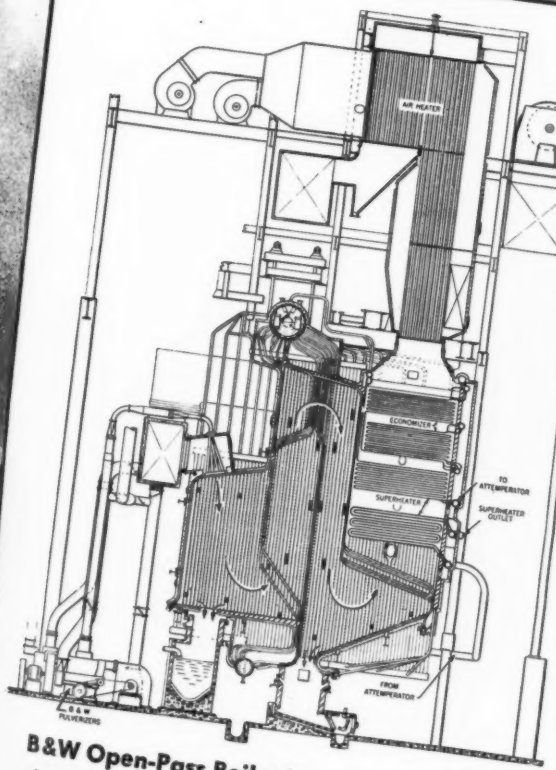

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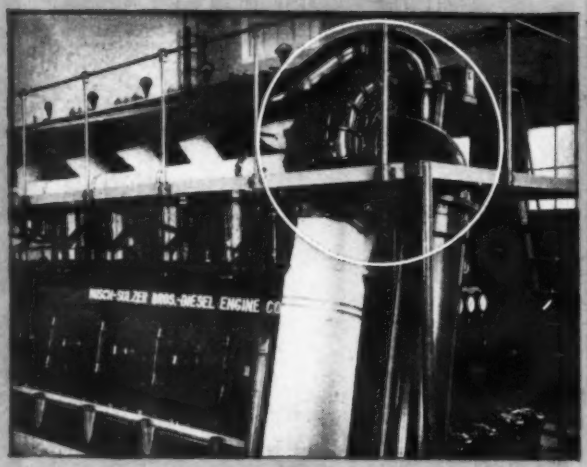
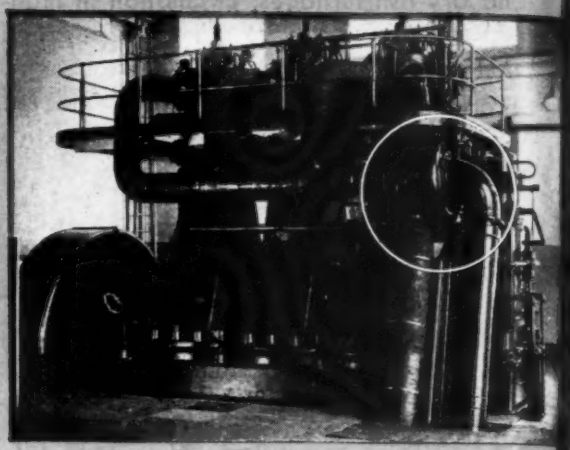
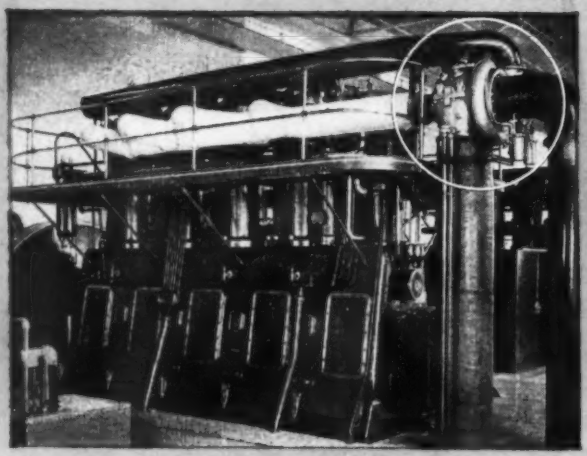
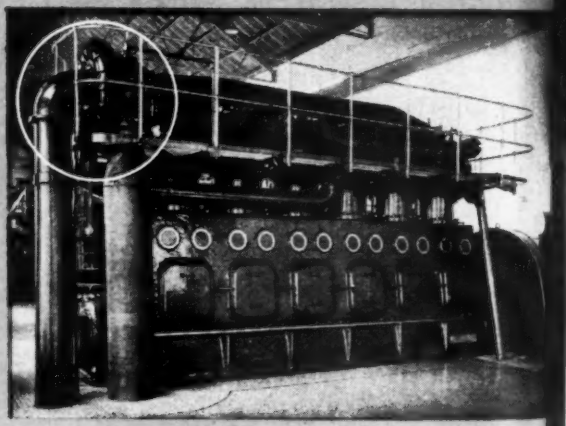
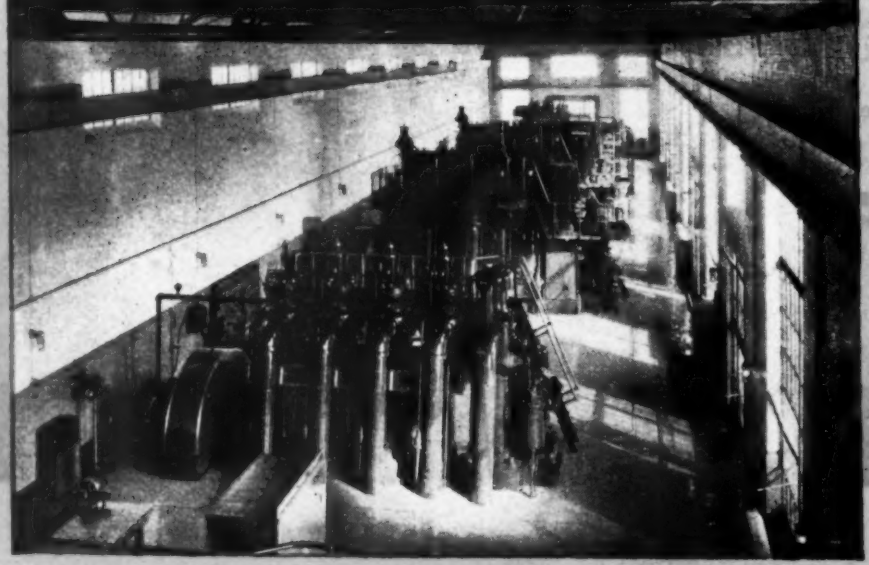




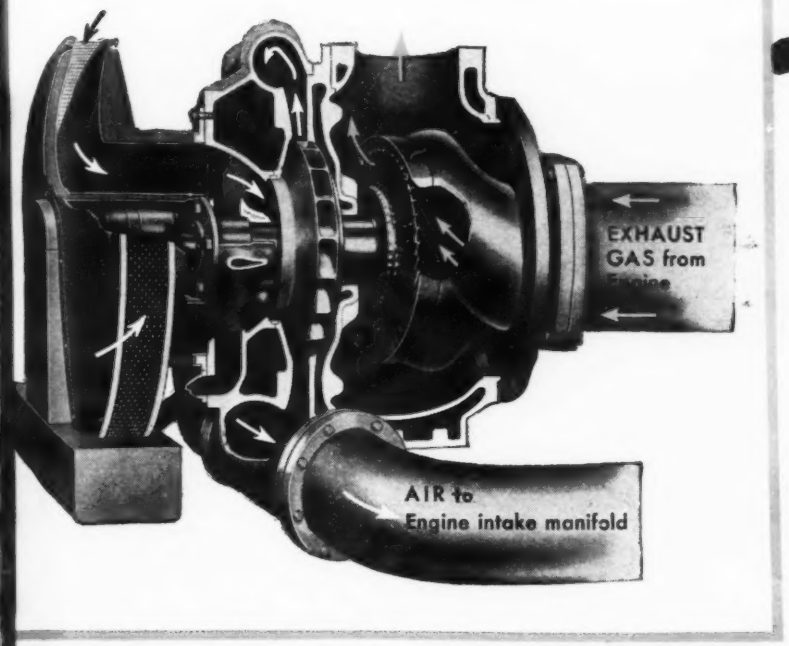






**Above are photos taken in s
tions of the pipe line compa
which stepped up movement
oil to the east, by adding Elli
Buchi turbochargers to many
the Diesel engines in their pu
ing stations. Turbochargers
encircled.**

to 9000 more barrels of due to Elliott turbochargers



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- Fully automatic at all loads—no control required.
- Over two million horsepower of Buchi system turbocharging now in service. Can be applied to existing 4-cycle Diesels, but more effectively to new engines designed to use it. Bulletin M-5 gives the full turbocharger story—write for it.

It was certainly an easy way to increase pipe line capacity, just when it was needed, when time was short, labor scarce, and materials difficult to obtain. The addition of Elliott-Buchi exhaust gas turbochargers to previously installed Diesel engines driving pumps stepped up oil movement to the east very definitely for this pipe line company. The increase is the equivalent capacity of two average size tankers, moving on a rapid prewar schedule.

While Elliott turbochargers are most effective when used with Diesels designed for their application, they still are vitally important power boosters on those previously installed 4-cycle engines. Many of these installations are now operating, all with gratifying success. These units are realizing up to 50 per cent more horsepower due to pressure charging and more efficient scavenging. Available for engine ratings above 250 hp — marine, stationary and locomotive.

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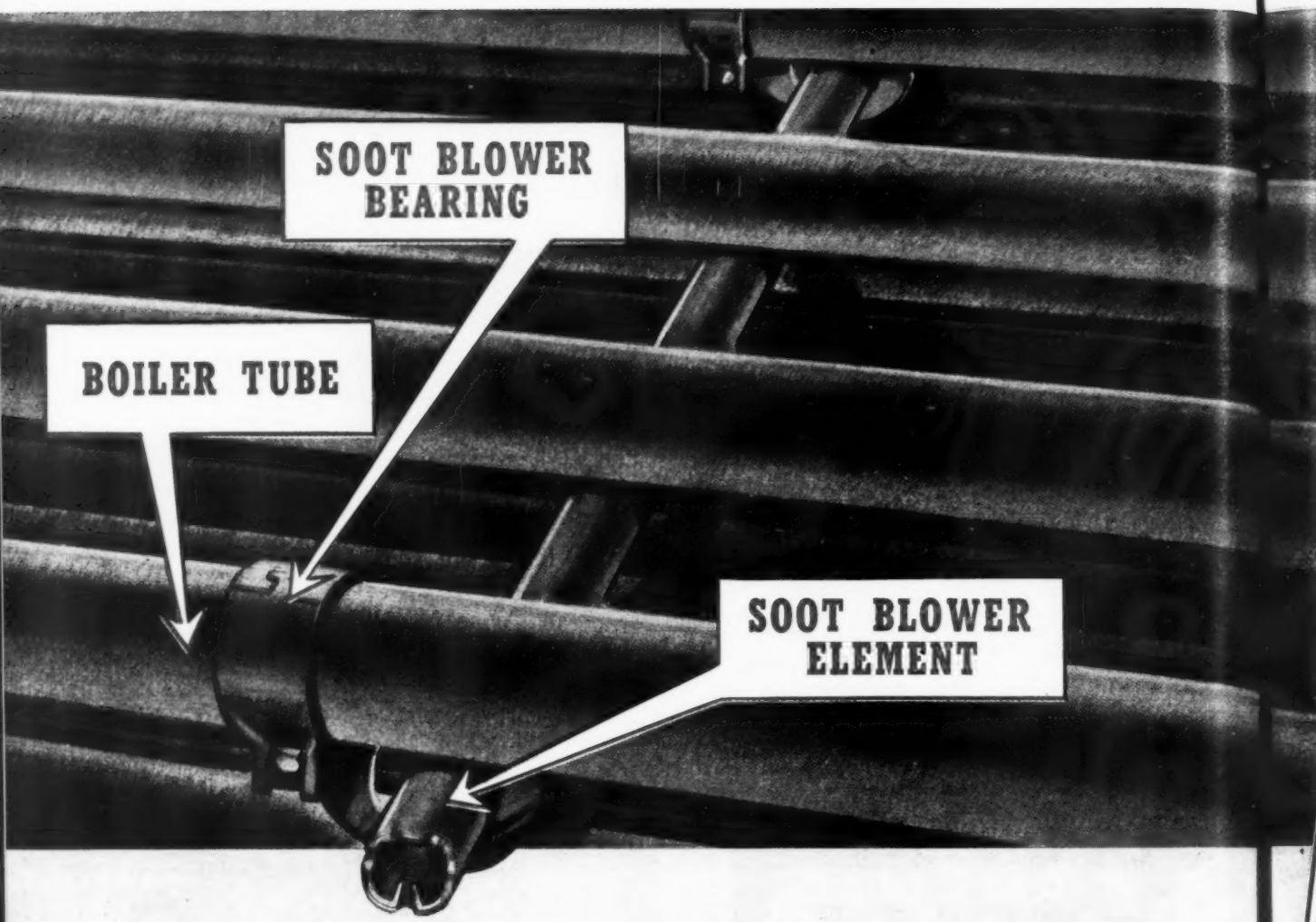


for better boiler cleaning and
longer blower element life . . .

KEEP YOUR SOOT BLOWER BEARINGS LINED UP

DIAMOND POWER SPECIALTY CORP.
DETROIT, MICHIGAN

HEAVY demands upon the Diamond organization for war needs often make it difficult for us to supply new soot blowers, or to supply repair parts as promptly as we would like. It is important to make the soot blowers you have give service as long as possible. Careful maintenance will prolong their usefulness, keep them efficient.

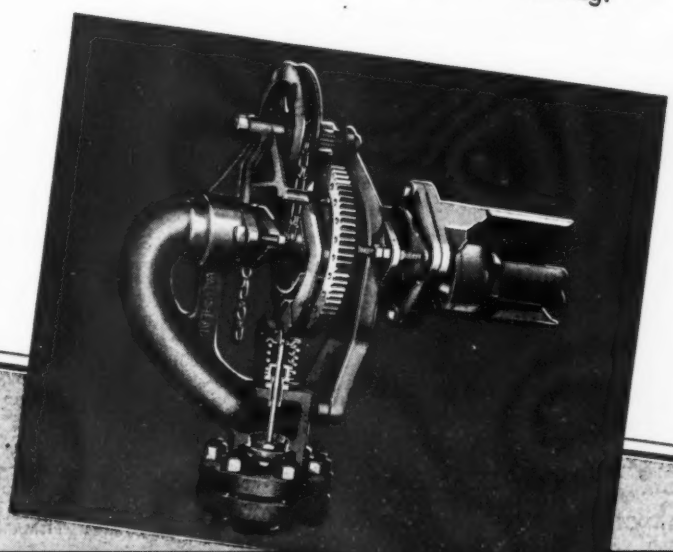
Bearings are important in the maintenance of soot blowers. Clamped bearings must be kept lined up. Serious misalignment may cause warped or broken blower elements. Every time a boiler is taken out of service, bearings should be examined and any misalignment corrected.

Bearings must be kept snug—close contact with the boiler tube cools the bearings. When tightening or renewing bearings, boiler tubes should be absolutely clean where the bearing comes in contact with the tube. After a bearing bolt nut is tightened, the bearing should be hammered lightly to be sure the bearing fits closely to the boiler tube. The nut can then usually be pulled up one or two more turns to insure the bearing being absolutely tight.

When installing new bearings, care should be taken to see that the proper number of bearings are used to support each element. In all cases, the first bearing from the head end is placed on the first tube from the wall, and in general, the bearings are spaced 9″ to 21″ apart for Calorized and Dialoy elements, and from 42″ to 48″ apart for plain pipe elements.

It is important that Calorized and Dialoy elements do not overhang the last bearing more than 11″. Where bearings are installed on every other tube, not more than one nozzle should overhang the last bearing. In the case of plain elements, not more than 24″ of the element should overhang the last bearing.

Write for this booklet on care of Diamond Soot Blowers.



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Professor of Mechanical Eng.
The University of Tennessee
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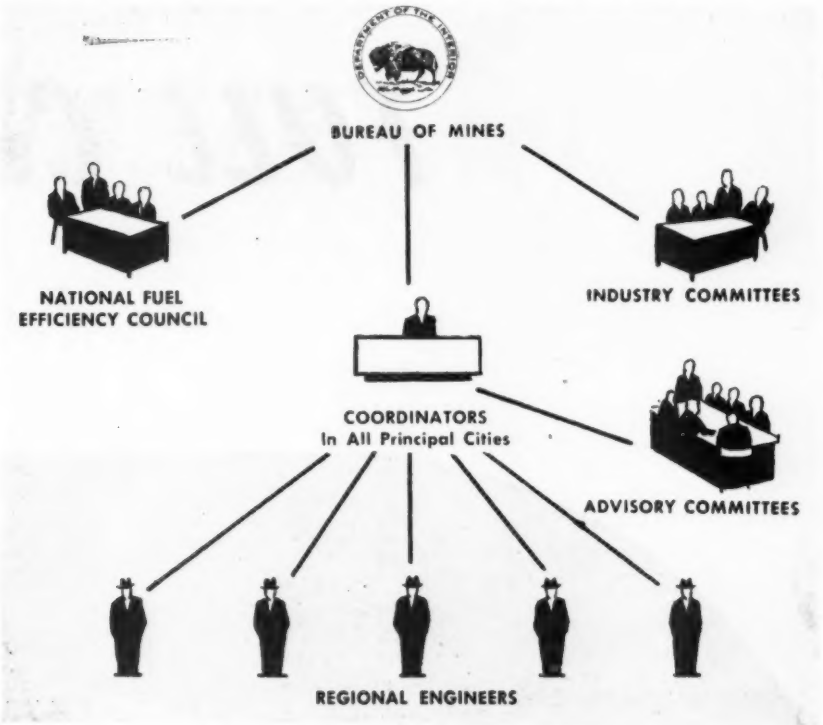
TO HELP YOU SAVE FUEL!

HOW THE NATIONAL FUEL EFFICIENCY PROGRAM FUNCTIONS



The calibre of these men – the Coordinators of the National Fuel Efficiency Council – speaks for the character of the program they have undertaken which is a drive by industry and for industry to help stretch the entirely inadequate fuel supply of America by promoting greater fuel efficiency and reducing heat losses.

Each of these coordinators will direct a group of regional engineers in his own locality – one of whom will visit your plant to enlist your cooperation. He will carry with him helpful information on fuel conservation which has been compiled by voluntary committees comprising the manufacturers of all classes of equipment used in the production and utilization of steam. All of these men are donating their services to help your country avert a disastrous fuel shortage.

If they succeed in attaining the first year's objective – the conservation of 29,000,000 tons of coal and proportionate amounts of gas and oil – they will help the country through the threatening winter of 1944-45 when fuel promises to be the most critical of all critical materials. If they succeed, they will avoid curtailment of war production and save industry from the threat of shortages that otherwise might require relief in some form of allocation.

And they will succeed if every man in industry who uses fuel recognizes the stark necessity of the situation in terms of the war effort abroad and civilian life at home – and lends his fullest cooperation. A-794

To obtain more details write the coordinator nearest you.

This space is contributed by the undersigned company for the purpose of furthering the important work of the National Fuel Efficiency Program.

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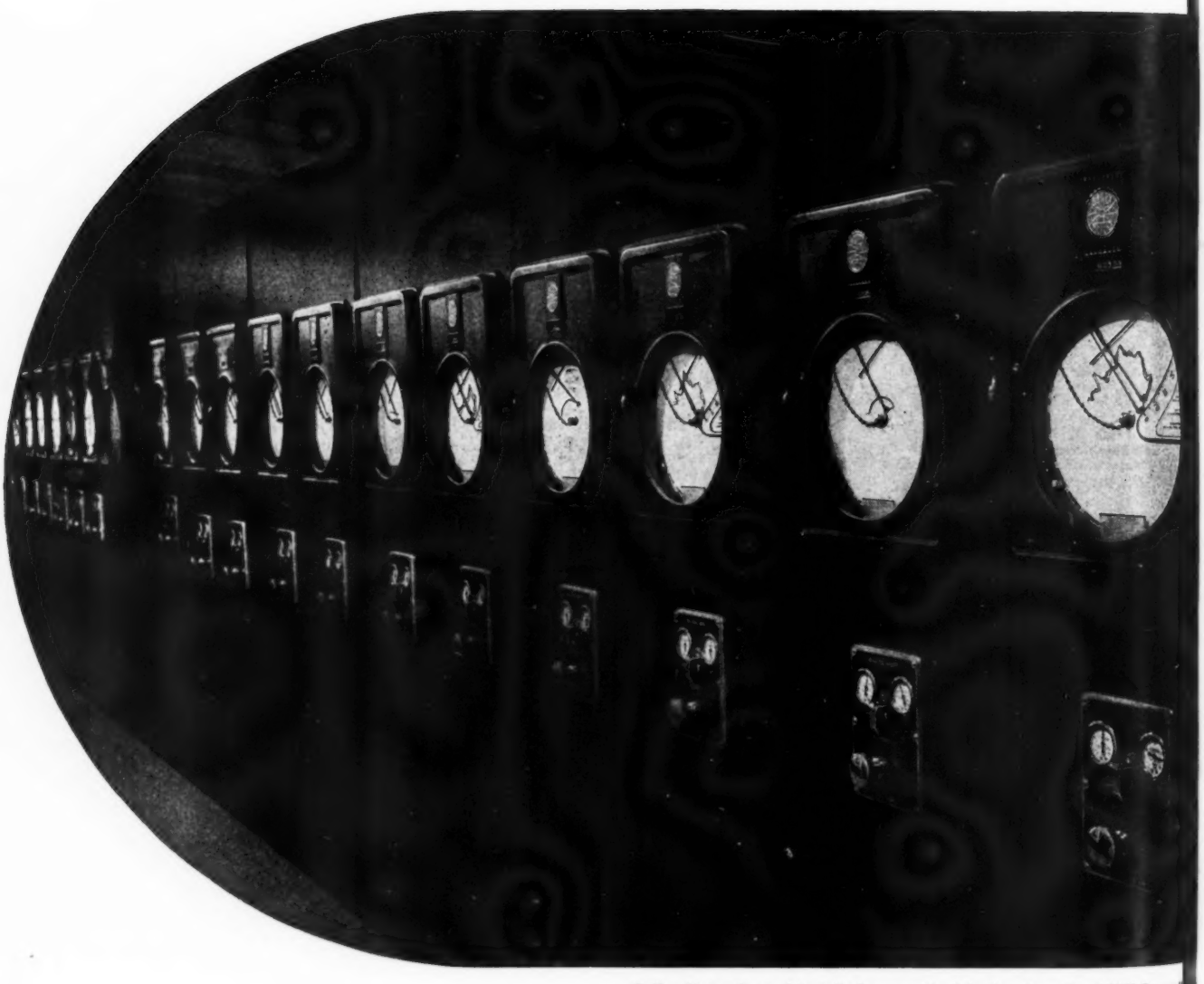

Bailey Meter Control installed on gas-fired boilers in a Steel Mill Power

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WITHOUT *WASTE* OR *OUTAGE*

Bailey Boiler Control Insures Safe Economical Operation At High Rates of Steaming

★ Full capacity is obtained from a steam generating unit only when the many factors which enter into its operation and control are carefully coordinated and accurately maintained at their optimum values.

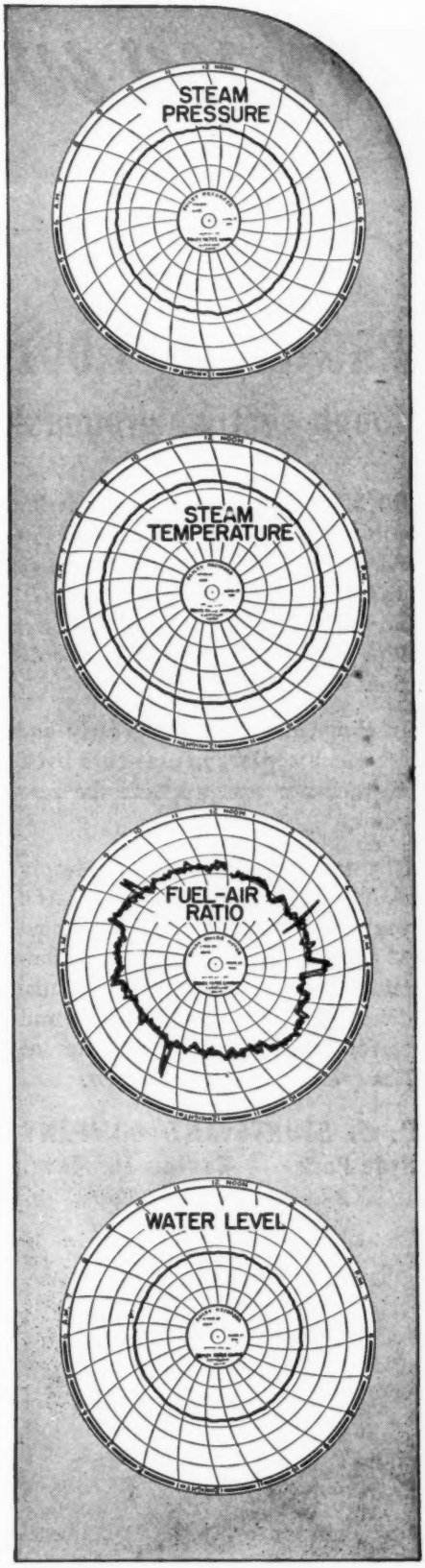
Care must be taken in approaching these optimum values since serious waste and danger of breakdown is likely to occur unless dependable measurements of the factors are made and continuous vigilance is exercised in their control.

Blind efforts to increase boiler capacities by raising combustion efficiency may result in waste of fuel and in serious damage to boiler furnaces.

High capacities may be safely and economically attained with the help of Bailey Boiler Control which continuously maintains the following factors at their optimum value:

1. Steam pressure; to provide maximum turbine efficiency and to prevent waste through safety valves.
2. Steam temperature; to provide maximum turbine efficiency and to prevent damage resulting from excessive temperatures.
3. Fuel—Air Ratio; to keep to a minimum the volume of gases which must be moved through the boiler per unit of heat release, and to reduce excess air loss to a minimum without decreasing fuel economy or damaging furnace refractories.
4. Feed water flow and level; to maintain a uniform heat demand and to avoid both "high" and "low" drum level.

Bailey Meter Control serves the war effort by making it possible for power engineers to carry on with safety and economy at full capacity in spite of wartime scarcities. A-88



BAILEY METER COMPANY
1036 IVANHOE ROAD • CLEVELAND, OHIO
Bailey Meter Company Limited, Montreal, Canada

he Complete Combustion Control System

TROL • DESUPERHEAT CONTROL • COMBUSTION CONTROL • FEED WATER CONTROL

How would YOU design

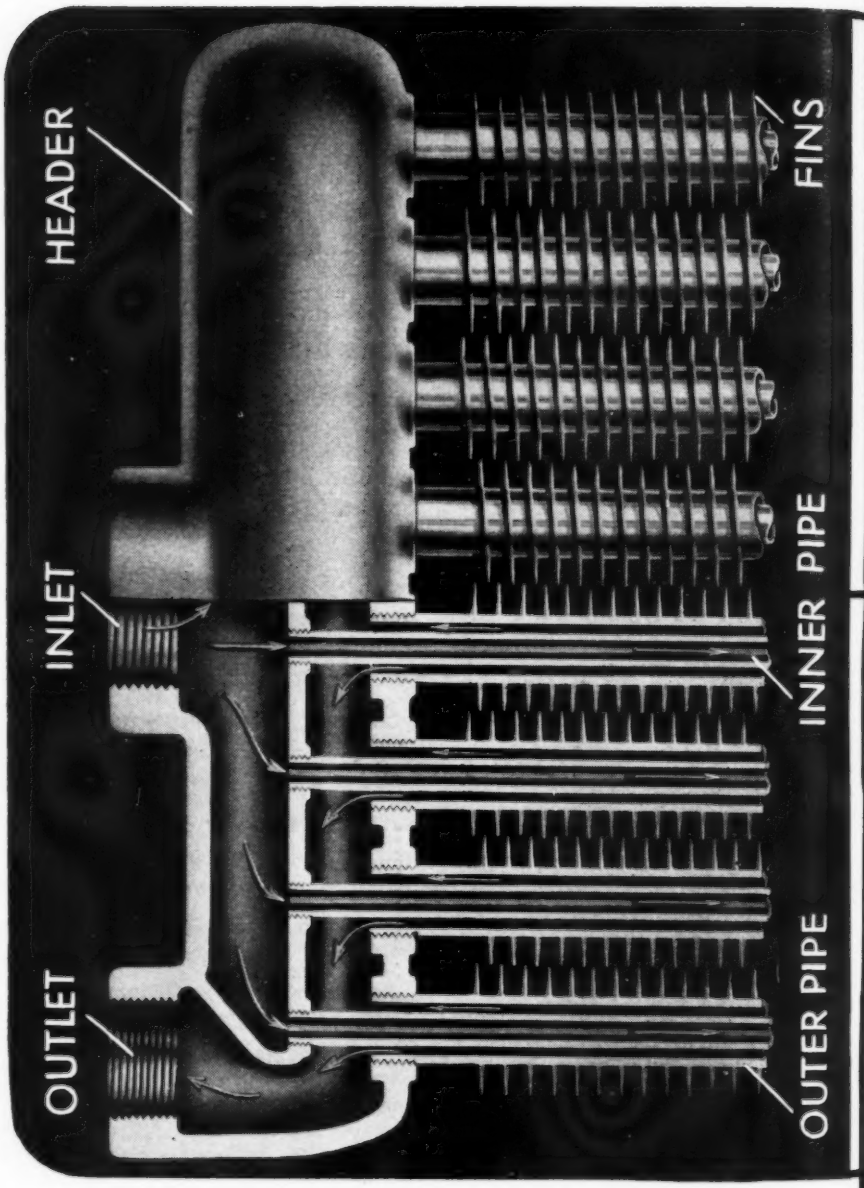
PROVED ON 1,001
tough testing grounds!

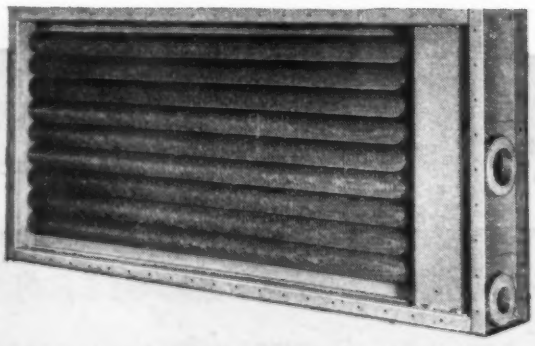
ON ALL TYPES of heating and drying jobs—from army installations in Alaska to war plants in America—on 1,001 tough testing grounds you'll find the Sturtevant Heavy-Duty Steel Pipe Heater *far exceeding* expectations and guarantees.

It eliminates the risk of early and frequent replacements—cuts back maintenance costs to near the zero point.

Why not get all the facts? Simply mail in the coupon below. We'll send you a free copy of our fully illustrated 32 page catalog (No. 462) which contains complete construction details, dimensions, operating principles and performance data of the Sturtevant Heavy-Duty Steel Pipe Heater.

B. F. STURTEVANT COMPANY
Hyde Park Boston 36, Mass.
Branches in Principal Cities

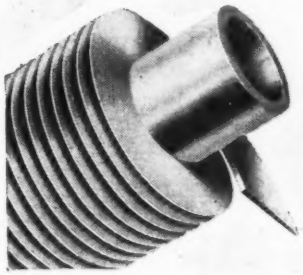




THE STURTEVANT HEAVY-DUTY STEEL PIPE HEATER IS NOT A WAR BABY

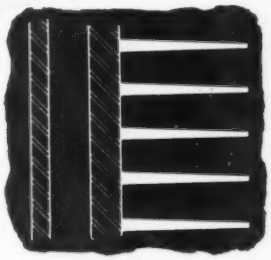
It was conceived, designed and *in service* long before this nation felt the first hot flames of battle. It was ready—the result of 8 years' careful research—to step in and help Uncle Sam arm and fight. Today, Sturtevant engineers welcome the opportunity to work with your post-war planners . . . to interpret heavy-duty heaters in the light of peacetime production problems.

a HEAVY-DUTY heater?



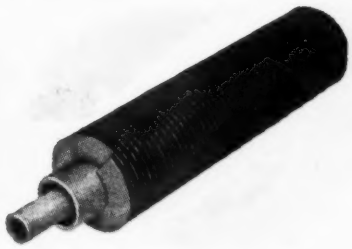
To withstand severe service conditions . . .

you'd build it around standard steel pipe. *That's what Sturtevant does!* Steam is carried in steel pipe from the time it enters the heater until it returns via the condensate line; there are *no* "weak links" in the heater system *from* the boiler *back* to the boiler.



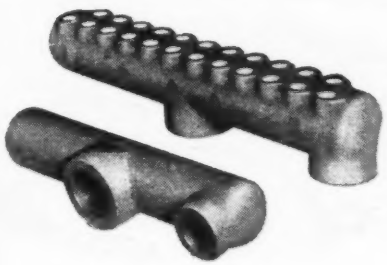
To speed air-flow . . .

you'd certainly want *smooth* fins. And that's what you get in the Sturtevant Steel Pipe Heater. No crimping cuts to create air resistance or accumulate efficiency-robbing dust. Another secret of high performance lies in the *tapering* fins . . . thickest at the base, tapering down toward the tip . . . resulting in a naturally greater, more even transfer of heat over the entire surface.



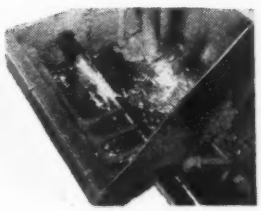
Freeze-ups must be guarded against . . .

so your design would incorporate pipe-within-a-pipe construction—just like Sturtevant's! The use of a single header leaves one end of the pipe free to take care of heavy duty expansion. The internal tube promotes free, unrestricted circulation—is just about the best bet for beating frost-burst coils.



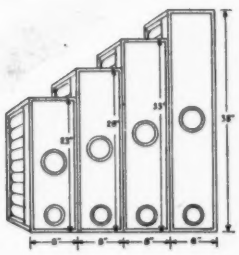
When it comes to installation . . .

of course, you may encounter space restrictions . . . another reason why you'd want the Sturtevant *single* header feature. This allows installation at almost any angle—vertically or horizontally. *Plus* factors include simplified installation . . . improved steam circulation. Headers are available for single or dual rows of coils, depending on heating capacity needed.



You'd most certainly consider heat transfer . . .

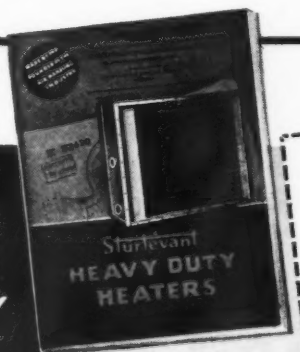
Here we see the fin pipe of a Sturtevant steel pipe heater passing through a solder bath which affords a metallic bond between the fin and the pipe. This means adequate contact for maximum heat transfer as well as protection of the external surfaces.



Now, best of all . . .

the Sturtevant Heavy-Duty Steel Pipe Heater is made in the same standard sizes used for copper units. It requires no more space—compares favorably in cost and is particularly adapted to use with steam in the higher temperature ranges. And you get the same guarantee that goes with a pre-war standard heating surface—*a full year's guarantee against any imperfections.*

SEND FOR THIS FREE CATALOG . . . TODAY!
IT CAN SAVE YOU MANY HEADACHES!



Sturtevant
REG. U. S. PAT. OFF.
Puts Air to Work

B. F. STURTEVANT COMPANY
Hyde Park, Boston 36, Mass.

Please send me the Sturtevant Heavy-Duty Steel Pipe Heater catalog No. 462—without cost or obligation.

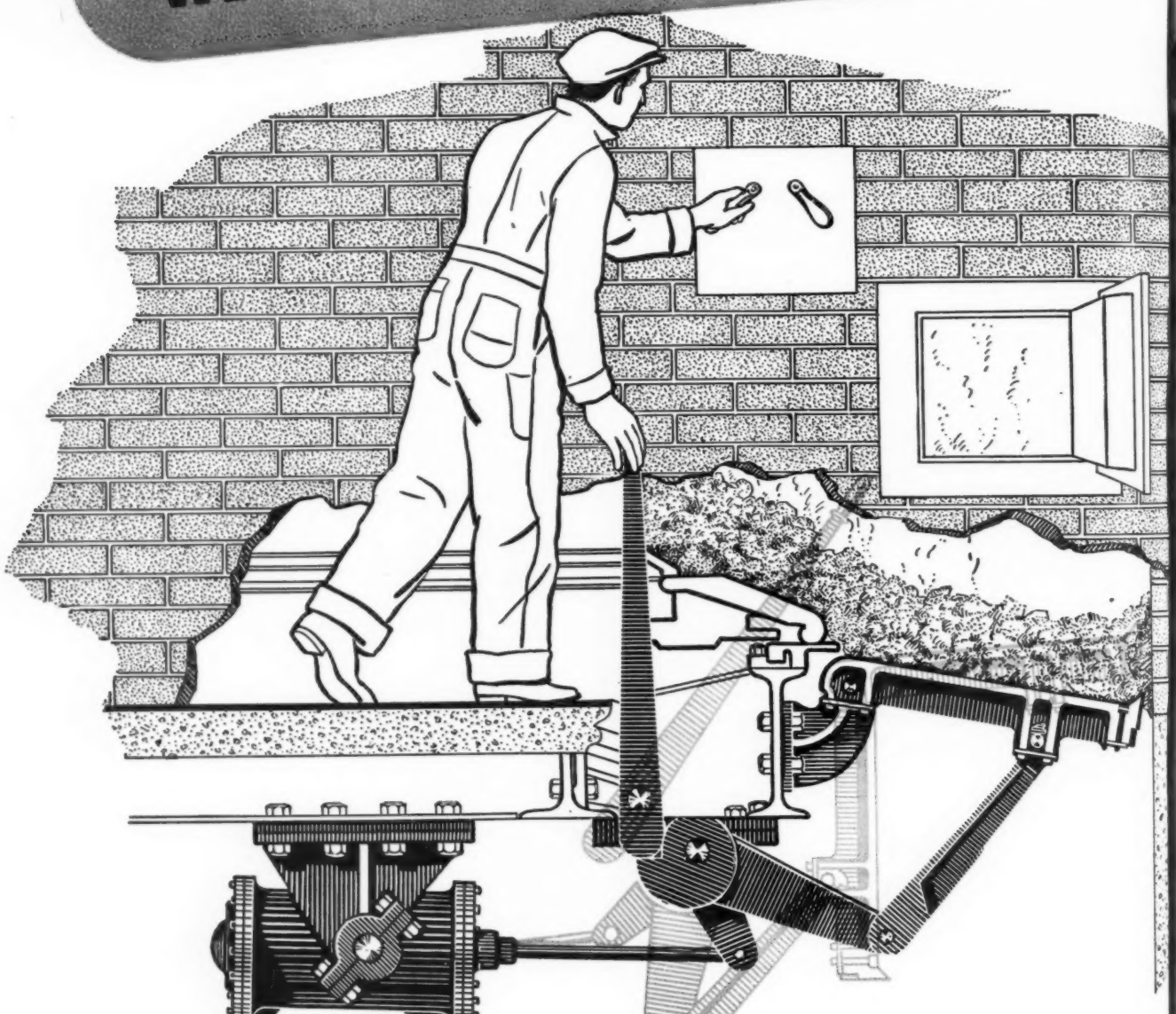
Name_____

Position_____

Company_____

Address_____

WHAT THE STEAM OPERATED



ASH DISCHARGE MEANS TO···

STOKER PERFORMANCE

WHERE there is a limited load condition and the use of furnace water cooling is not justified, Taylor Stoker design includes the Steam Operated Ash Discharge. With this feature ashes can be dumped and bridge wall sheared free of clinkers in a fraction of a minute without manual labor.

Due to an exclusive feature of the Taylor Steam Operated Ash Discharge, clinkers may be cleared from the rear wall anytime between dumping periods. This means removal while they are in plastic condition, preventing injury to the brick work.

Aside from ease of operation and lower brick work maintenance costs, the Steam Operated Ash Discharge has five other features that improve stoker operation or lower operating expenses:

1. Single leaf dump plate provides maximum discharge area.
2. There are no right and left sections so that all plates are interchangeable.
3. Dump plates are heavy cast iron.
4. Dump plates can be removed by simply knocking out two pins.
5. Controls are conveniently located so operator can readily observe dump plate while controlling its movement.

It is the combination of many advantages such as the Steam Operated Ash Discharge that make the Taylor Stoker a highly efficient unit, low in operating and maintenance costs.

JUDGE THE SELECTION OF FUEL FIRING EQUIPMENT BY THESE TWELVE POINTS

1. **RELIABILITY**—the ability to operate with minimum outage and minimum standby equipment.
2. **CAPACITY**—the ability to provide adequate prime capacity ratings, with sufficient reserve capacity for emergencies.
3. **MAINTENANCE**—the ability to operate continuously with minimum repair costs.
4. **FLEXIBILITY**—the ability to follow the steam demand upward or downward . . . quickly and without sacrificing efficiency.
5. **EFFICIENCY**—the proved dollar efficiency (total cost of steam production) as shown by actual performance in similar installations.
6. **OPERATION**—the ability to operate continuously, the number and type of operations required, the ease of combustion adjustments, etc.
7. **ADAPTABILITY**—the ability to meet special and limiting conditions, present and future—structural limitations, utilization of present equipment, growth and change of power service demands.
8. **FUEL FLEXIBILITY**—the ability to burn efficiently and easily fuels from many sources having widely varying characteristics.
9. **REFUSE DISPOSAL**—the ability to economically eliminate ash or refuse and the opportunities of disposal at low cost, no cost, or profit.
10. **STACK DISCHARGE**—the practical elimination of "smoke nuisance" without special equipment.
11. **SPACE REQUIREMENTS**—the ability to conform to existing or future space limitations, to short and wide or long and narrow furnaces. Also the accessibility of component parts for maintenance and operation.
12. **OBSOLESCENCE**—the adaptability of the equipment toward possible future modernization with minimum of complication and outage.

A-E-CO TAYLOR STOKERS • LO-HED HOISTS
HELE-SHAW FLUID POWER • MARINE DECK AUXILIARIES

A-E-CO TAYLOR STOKER

AE CO

AMERICAN ENGINEERING COMPANY

PHILADELPHIA 25 • PENNSYLVANIA

Meet Mr. Quality

ONE LOOK AT Bill Seebode — 50 year man at Allis-Chalmers Norwood Works — tells you that he sleeps well nights.

One reason is that he and hundreds of his fellow craftsmen at Allis-Chalmers have won *and are keeping* the confidence of engineers and operating men throughout American Industry.

That means a lot to veterans like Bill who've made a career of building great motors.

Bill's a stator-winder, as you can see—a living example of the truism that *men* make motors.

No machine known can assemble the maze of wiring and insulation that goes into a stator with his skill and care. No machine can fully test how *well* he's done his job.

There's only one test . . . wait 5, 10, 15 years and *see*.

And that's the test that has proved Allis-Chalmers motors are *great* motors. That's why you hear it said so often: *"You can depend on Allis-Chalmers Motors!"*

Yes, hundreds of Allis-Chalmers men—*quality* men like Bill Seebode — know they have a big personal stake in every Allis-Chalmers motor. When they build a great motor for you, they're making a friend . . . and they know that's something no company and its workers can have too many of. ALLIS-CHALMERS, MILWAUKEE 1, WISCONSIN.

• • •

♪ *Tune in the Boston Symphony, Blue Network, Saturday at 8:30 pm, EWT.*

A 1729

YOU CAN DEPEND ON ALLIS-CHALMERS MOTORS

Why Nonpareil Turbine Oil is sold with a guarantee... good for the life of your turbine

• OF COURSE, there's nothing unusual about a turbine oil lasting several years, if the operator wants to take the time and trouble to remove contaminants regularly. It *is* unusual, however, when a turbine oil lasts indefinitely, and does so without sweetening, batch treatment, resting, or replacement, and without any cleaning of the turbine. That is one distinguishing characteristic of Nonpareil Turbine Oil . . . another is the written guarantee with which it is sold.

By the terms of this guarantee—good for the life of the turbine—Nonpareil's acidity (as expressed by neutralization number) will never exceed the extremely low limit of 0.15. In actual practice, the neutralization number is more likely to be around 0.05, as has been proved in hundreds of turbines.

This ability to retain "new oil condition" is the result of Nonpareil's manufacturing process by which we entirely remove the highly unstable compounds, and inhibit the others against oxidation. Those that are removed would tend to form contaminants of asphaltene type. These are objectionable because they settle out, they may plug lines, and they cause water sludge deposits.

Nonpareil refining versus "conventional." The combination of advantages covered by the Nonpareil patent—the addition of an inhibitor to an oil from which all unstable compounds have been removed—is highly important. For the *mere elimination* of the unstable compounds has serious drawbacks—it removes the natural inhibitors. In fact, many of the asphaltene-formers, possibly most of them, are the natural inhibitors. When all of them are removed, the oil oxidizes to form acids which in turn contribute to emulsion and sludge formation.

To prevent this, the customary refining method is to leave in the oil some of the asphaltene-formers for their inhibiting effect—in spite of the certainty of asphaltene deposits.

The Nonpareil method of adding an inhibitor to asphaltene-free oil has the obvious advantage of eliminating trouble from both types of deposits. This explains why Nonpareil *can* be, and *is*, sold with a written guarantee and why the guarantee is good for the life of the turbine.

Corrosion control another feature. A corrosion inhibitor has been used in Nonpareil Turbine Oil since 1926. But a continuous study of this problem has been carried on. Hundreds of materials have been examined and thousands of tests made. An improved corrosion inhibitor is now used in Nonpareil which meets all requirements of corrosion protection without impairing other desirable qualities.

Recently the American Society for Testing Materials developed test D665-42T for determining the ability of turbine oil to aid in preventing the rusting of ferrous parts in the presence of water. Nonpareil Turbine Oil passes this test with perfect results.

Get all the facts. A Standard Lubrication Engineer will be glad to supply full test data and service records on Nonpareil. Call any Standard Oil Company (Indiana) office, or write 910 S. Michigan Avenue, Chicago 80, Illinois. In Nebraska, address Standard Oil Company of Nebraska at Omaha 2.

Oil is Ammunition . . . Use it Wisely

NONPAREIL TURBINE OIL

STANDARD OIL COMPANY (INDIANA) STANDARD SERVICE

★ LUBRICATION ENGINEERING

Standard Coded Lubrication Service

. . . just as easy as it looks to get the right lubricant in all the right places

● A SIMPLE NUMBERED SYSTEM—that speaks all languages—tells oilers what lubricant is needed and where it goes. Ask the men in charge of your lubrication, if that isn't just what they have been waiting for.

They know it's comparatively simple in most instances to pick the right lubricant for the job. It's another matter to be sure *that* lubricant—and *only* that one—is applied *every time.* The illustration at right shows how easily Standard *Coded* Lubrication Service solves this problem for you. Here's the key:

A. A code number is assigned to each lubricant used in the plant, and a bright decal applied to each storage container indicating the lubricant it holds. (Follow lubricant #2 in the illustration.)

B. Every container on the lubrication cart (if one is used) is also marked with this code number by a decal. (Lubricant #2 only is marked in the picture.)

C. Every oil can—or grease gun—is identified by a decal and filled from the cart or storage container with that numbered lubricant. (Again #2 in the picture.)

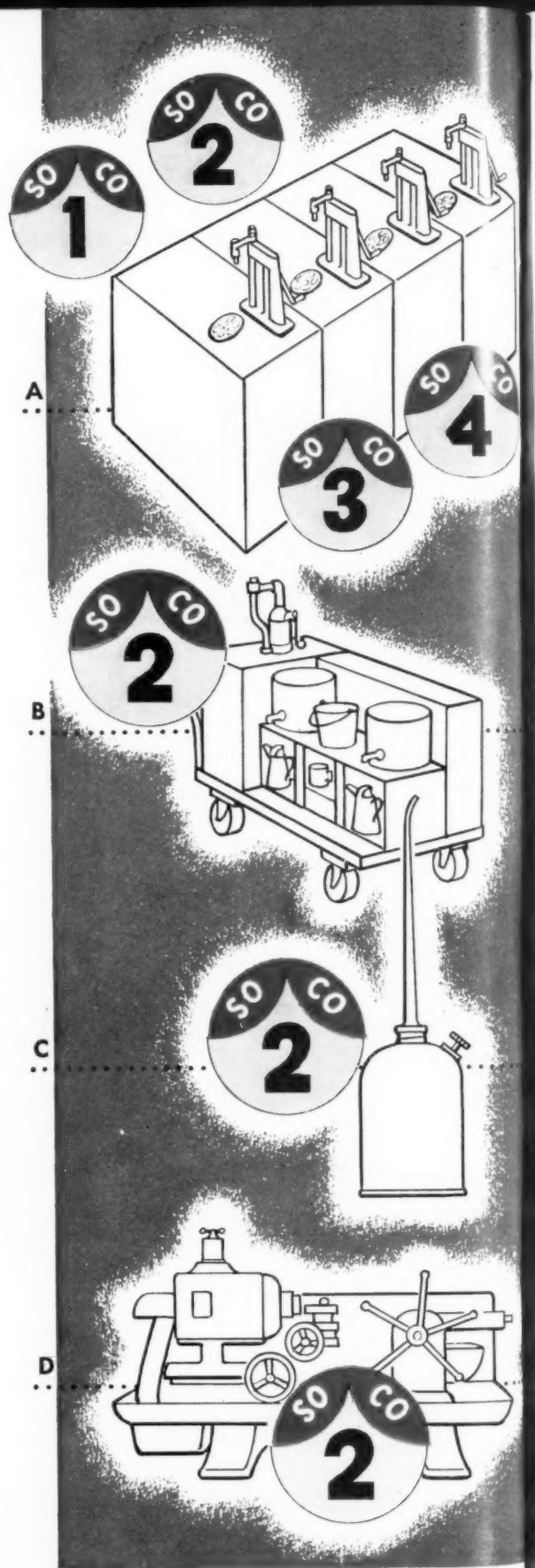
D. Every spot to be lubricated on each machine is marked with the code number of the lubricant required.

Your oilers simply follow the numbers in getting the right lubricant where it belongs. In addition, however, you can have machine record cards for each machine showing the number of points to be lubricated or other information which may seem necessary.

The only record you keep is a lubrication chart listing the lubricants used in your plant, and the code numbers assigned to them. This chart is made when you install the system, and is kept in the oil room with duplicates in other files as needed for reference. Lubricants are ordered by brand names just as you do now and applied by numbers. The code numbers you assign have no significance elsewhere.

Here's how to get this service. Discuss this plan with your lubrication men. Ask to have a Standard Oil Representative call and explain the details. Whether you use Standard Oil's Lubricants exclusively or not, if your plant is in the Middle West, you can get this service—including decals, forms, and help in installing the system, or *fitting it into your present system.* Simply call the nearest Standard Oil Company (Indiana) office, or write 910 S. Michigan Avenue, Chicago 80, Illinois. In Nebraska, write Standard Oil Company of Nebraska at Omaha 2.

Gasoline Powers the Attack . . . Don't Waste a Drop



STANDARD OIL COMPANY (INDIANA) STANDARD SERVICE

★ LUBRICATION ENGINEERING

COTTRELL PROCESS

of

ELECTRICAL PRECIPITATION

universally recognized as a
standard method of removing

DUST, FLY ASH, FUME, MIST & FOG

***from* GASES**

•

30 years of research, development and operating experience throughout the world are incorporated in the

COTTRELL INSTALLATIONS

offered to meet the requirements
of any problem by

RESEARCH CORPORATION

405 LEXINGTON AVENUE
NEW YORK CITY

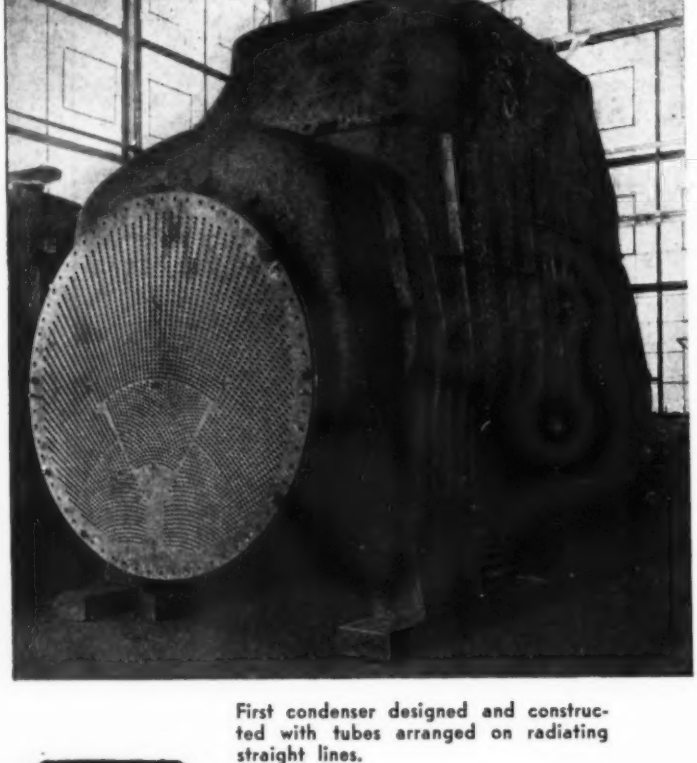
59 EAST VAN BUREN STREET
CHICAGO, ILL.

Blazing THE Condenser

RADIATING TUBE ARRANGEMENT

★ In 1924 the first condenser with tubes arranged on radiating straight lines was put into operation at the plant of the Rockford Electric Company, Rockford, Illinois. Since then, this fundamental improvement in design has gained wide acceptance . . . and is used in more than one thousand condensers constructed by Foster Wheeler alone.

Steam lanes of uniformly decreasing area are provided between the rows of tubes. This design effects a high rate of heat transfer throughout the condenser and offers minimum resistance to steam flow.



First condenser designed and constructed with tubes arranged on radiating straight lines.

Foster Wheeler is a Three Star Winner under the U.S. Navy Board of Awards for production.

FOSTER WHEELER CORPORATION

165 BROADWAY
NEW YORK 6, N. Y.

FW FOSTER

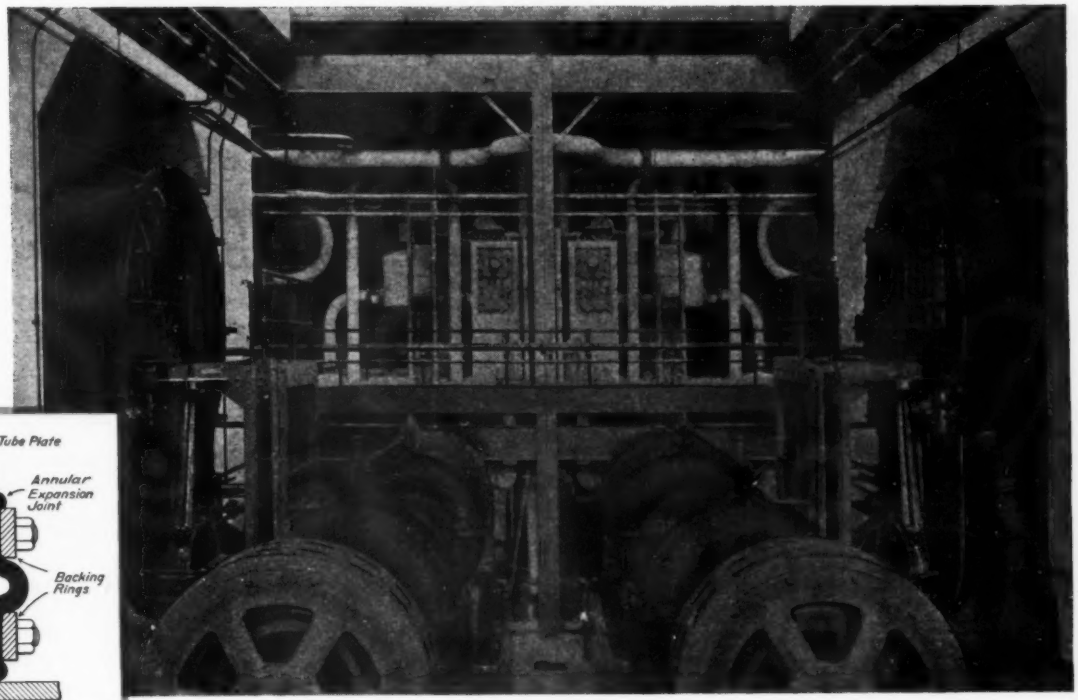
ENGINEERING TRAIL

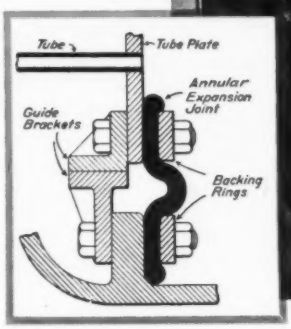
Development

EXPANDED TUBES

★ The first surface condenser to have all tubes expanded into tube sheets at both ends was designed and built by Foster Wheeler twenty-one years ago for the Texas Power and Light Company, Trinidad, Texas. This construction insures permanently tight joints to eliminate contamination of condensate by the circulating water.

Performance of this installation was so eminently satisfactory, showing far greater purity of condensate than obtained from other designs, that the principle of expanding condenser tubes at both ends has since become a standard practice.





Expansion joint for floating tube sheet condensers used in the Trinidad units and in many of today's designs.

Condensers of the Trinidad Station of Texas Power and Light Company were the first to have all tubes expanded into tube sheets at both ends.

WHEELER FW

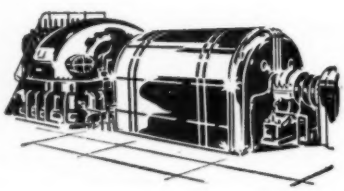
ALL TURBINE OIL STANDARDS

Greatest Turbine Oil Development meets the most severe operating

NEW GARGOYLE

Now in service in all-size Turbines after proving its superiority in gruelling oxidation tests!

FOR YEARS, Socony-Vacuum's Gargoyle D. T. E. Oils have set the performance standards for turbine oils. Constant improvements have maintained these standards.



Now comes a major development that can't be treated as just an improvement, a long step forward that meets today's most severe turbine operating conditions. Never satisfied, Socony-Vacuum has created a great new Gargoyle D. T. E. Oil for turbines.

The base stock of this oil, Gargoyle D.T.E. Oil 797, is in itself a high-grade turbine oil. To this oil — by special processing — we have added the ultimate in resistance to oxidation and a maximum anti-rust quality.

The result is an *ideal turbine oil!* In extremely severe comparative tests it eclipsed all leading turbine oils in resistance to oxidation. This oil, now in service in turbines ranging from 1500 KW. to 50,000 KW., is proving its superiority under most severe operating conditions.

SOCONY-VACUUM OIL CO., INC.•Standard Oil of N.Y. Div.•White Star Div.• Lubrite Div.• Chicago Div.• White Eagle Div.• Wadhams Div. • Magnolia Petroleum Co. • General Petroleum Corp. of Calif.

FROM THE WORLD'S LEADER IN LUBRICATION

TOPPED!

since the First Gargoyle D.T.E. Oil conditions of today's Turbines...

D.T.E. OIL! NEW

GARGOYLE

Lubricants

WHAT MAKES A GREAT TURBINE OIL?

✓ ***Excellent Base Stock:*** The fundamental requirement for an ideal turbine oil is a base stock that in itself is an excellent turbine oil with excellent resistance to oxidation.

✓ ***Extra Resistance to Oxidation:*** Oxidation protection—PLUS—is needed to meet the effect of greatly increased temperatures in modern turbine operation. Your turbine oil should have this PLUS protection.

✓ ***Maximum Anti-Rust Qualities:*** The possibility of the presence of water demands that the oil should furnish maximum protection against corrosion. Your turbine oil should give this protection.

THE NEW GARGOYLE D.T.E. OIL 797 HAS ALL OF THESE NECESSARY CHARACTERISTICS

Socony-Vacuum Oil Company, Inc.

NEW LEADERSHIP...to bring you unmatched engineering, research and manufacturing facilities

Plus...

McALEAR
PRESSURE · FLOW · LIQUID LEVEL · TEMPERATURE
controls
for STEAM, WATER, AIR, OIL and GAS

Now...

H-W

McALEAR
PRESSURE · FLOW · LIQUID LEVEL · TEMPERATURE
controls
for STEAM, WATER, AIR, OIL AND GAS

WELDED TANKS
BOLTED TANKS
SEPARATORS

McALEAR MANUFACTURING CO.
HANLON-WATERS INC.

now One!

An Announcement of Major Significance to every user of Automatic Control Instruments

HENCEFORTH, McAlear and Hanlon-Waters will function as divisions of *one* company. This brings together the leading supplier of automatic control instruments for the oil field and the foremost producer of similar devices for heating and industrial service.

Hanlon-Waters products will continue to be available to the oil field from the Tulsa plant, under the same management and engineering supervision as heretofore.

McAlear, whose products have for a third of a century dominated the process, industrial and heating fields, will continue to operate out of Chicago.

Customers of each company will benefit from this pooling of patents, designs and—*engineering experience.* The Hanlon-Waters oil field line of automatic controls, separators and tanks, will be immediately supplemented by such McAlear controls as the combined engineering staffs of the two companies regard to be best for such service. Similarly, the McAlear line will be complemented by outstanding features and products of Hanlon-Waters manufacture.

This affiliation provides unmatched manufacturing, engineering and research facilities. The new leadership thus established will find quick expression in new control developments (some already well under way) which will pace future industrial progress.

McALEAR MANUFACTURING COMPANY · CHICAGO
Control Instruments for Industrial, Power and Heating Service

HANLON-WATERS COMPANY · TULSA, OKLAHOMA
Control Instruments, Tanks, Separators, Portable Pipe Lines, for the Petroleum Field

AFFILIATED COMPANY
CLIMAX ENGINEERING COMPANY · CLINTON, IOWA
Gas, Butane and Diesel Engines, Generating Sets

SOLVE YOUR SPEED REDUCTION PROBLEMS

with Westinghouse Gearmotors

80% of all motor-driven machines, 1 hp and above, must operate at slower speeds than the motors which drive them.

Consequently, some type of speed reduction must be inserted between the motor and the driven machine. The best method of accomplishing this is by the use of Westinghouse Gearmotors which are slow-speed drives with high-speed motor efficiencies.

The product of more than 50 years of gearing experience, these Westinghouse units are designed, built, tested and guaranteed as single units.

Ask your Westinghouse representative about this new, efficient gearmotor. Consult with him about your present speed reduction problems or postwar plans.

Type C — A double-reduction unit for standard ratios from 7.6:1 to 25.7:1, inclusive.

Write for new gearmotor handbook, "Gearmotor Applications". Ask for B-3218. Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., Dept. 7-N.

J-07217

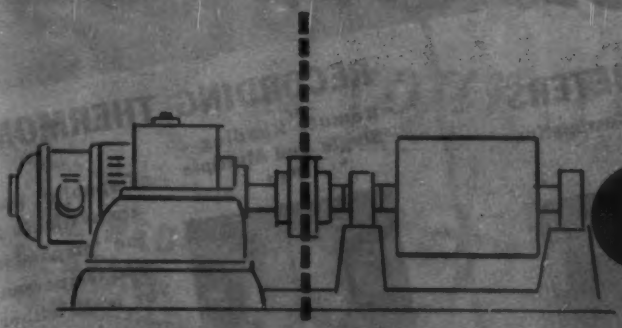
First of a series sponsored by Westinghouse to promote the use of gearmotors.

The New Westinghouse

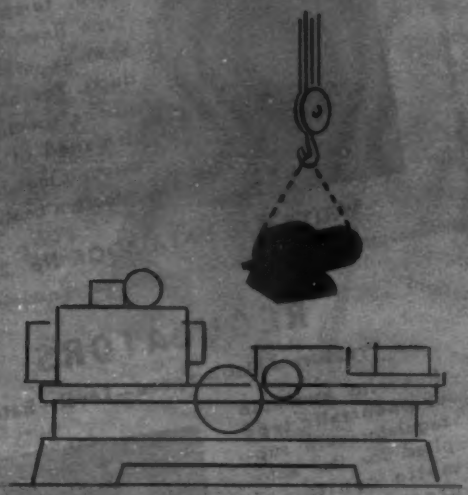
PLANTS IN 25 CITIES... OFFICES EVERYWHERE

A GEARMOTOR IS THE MOST EFFICIENT MEANS OF SPEED REDUCTION

Because it offers:



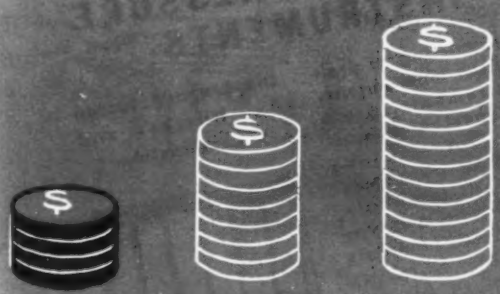
1 **COMPACTNESS . . .** it takes less space than any other form of parallel shaft speed reduction . . . makes belts, belt guards, pulleys, overhead line shafts *unnecessary*.



2 **LONG LIFE—MINIMUM MAINTENANCE.** A gearmotor has no belts, chains or ropes to replace . . . no multiple-parts to realign . . . no bearings to oil . . . no gears to grease. Probable maintenance consists of a twice-a-year oil change.

3 **EASE OF INSTALLATION.** By combining the prime mover and speed reducer in a single unit, the gearmotor is installed quickly and inexpensively.

4 **HIGH EFFICIENCY.** Only 2% power loss is involved in each stage of reduction . . . a single-reduction unit is 98% efficient; a double-reduction unit is 96% efficient. Compare this with the efficiency of other types of slow-speed drives.



5 **LOW OVER-ALL COST.** The initial installed cost of a gearmotor is usually lower than any other type of speed reduction. On the basis of maintenance and power losses, a gearmotor is *always* most economical.

6 **SAFETY FOR WORKERS.** A gearmotor has no exposed moving parts... no belts, pulleys, chains or ropes to endanger workers. It is totally-enclosed in a streamlined housing.

Gearmotors

B. t. u. Savers+

CO_2 METERS

An Automatic Orsat—For Checking Combustion Efficiency

For every fuel and boiler, there is a definite percentage of CO_2 in the flue gas that will assure highest combustion efficiency. Less than this amount indicates an excess of combustion air, causing high stack loss. The CO_2 meter is the only method of accurately determining combustion efficiency.

WRITE FOR DATA BOOK No. 403

RECORDING THERMOMETERS

Remote Reading—Single and Multiple Pen

Republic thermometers are available for recording temperature of flue gas, temperatures in vats or tanks either open or closed and under pressure, temperatures in pipe lines, refrigeration systems, ovens, kilns or ducts. For unusual conditions, special bulbs are furnished of corrosion resisting metal or with a protective coating.

WRITE FOR DATA BOOK No. 210

FLOW METERS

Electrical Remote Reading Type

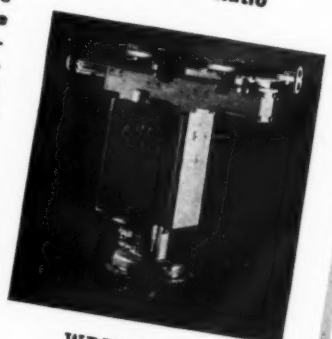
Republic electrical type flow meters are available for measuring the flow of all types of liquids and gases. Meter bodies are built for metering fluids at line pressures up to 10,000 lb. per sq. in. and for all ranges of differential pressure. The reading instruments — indicator, recorder and integrator — are of the remote reading type.

WRITE FOR DATA BOOK No. 701

REGULATORS

Pressure—Flow—Speed—Level—Ratio

Republic hydraulic or pneumatic type regulators are supplied for the automatic control of pressure, rate of flow, speed of rotation, level of a liquid or the proportioning of two pressures, flows, etc., in a fixed ratio by mechanically operating a valve, damper, rheostat or various types of variable speed transmissions.



WRITE FOR DATA BOOK No. S-13

FLOW METERS

Mechanical Float Type

The Republic mechanical float type meter is a simple, accurate metering device for measuring the flow of steam, water, gas, compressed air, oil, brine and other fluids. It has been designed primarily for installations where remote registration is not required.

WRITE FOR BULLETIN No. 312

DRAFT AND PRESSURE INSTRUMENTS

Diaphragm Actuated Any Number and Combination

Proper regulation of draft is one of the most important requirements in obtaining highest combustion efficiency. For indicating and recording drafts, pressures and differentials, Republic dry-bellows type indicators and recorders are supplied for all ranges encountered in furnace operation in any desired combination.

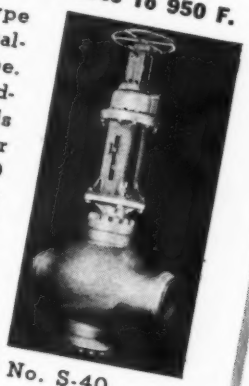
WRITE FOR BULLETIN No. 802

that will help you stretch your fuel supply

PRESSURE REDUCING AND REGULATING VALVES

Pressure To 2500 lb.—Temperatures To 950 F.

Republic turbine type valves are of the gradual-opening, high-lift type. They are built in accordance with A.S.A. standards and can be supplied for all pressures up to 2500 lb. per sq. in. and for temperatures up to 950 F and for any specified capacity. Republic valves will regulate down to 2% of maximum flow.

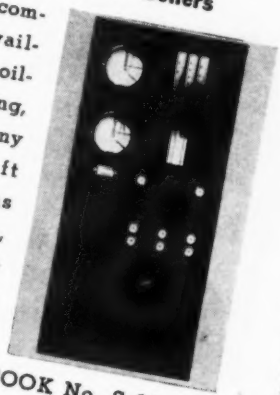


WRITE FOR BULLETIN No. S-40

COMBUSTION CONTROL

For All Sizes and Types of Boilers

Republic automatic combustion control is available for all sizes of boilers, all types of fuel firing, all load conditions and any arrangement of draft equipment. It maintains constant steam pressure, highest combustion efficiency, desired load division, constant furnace draft.



WRITE FOR DATA BOOK No. S-21

DESUPERHEATERS

Built To Meet Your Specific Requirements

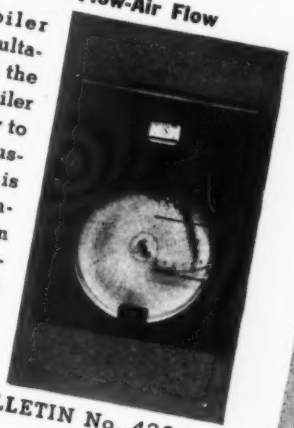
Whatever your plant conditions, you can obtain the necessary operating flexibility and accurate regulation of steam temperature with rugged, simply-controlled Republic desuperheaters. These are of the venturi type, with ratio or ratio-tank control, the steam atomizing type and the mechanical atomizing type.

WRITE FOR DATA BOOK No. S-35

BOILER METERS

Record Steam Flow-Air Flow

The Republic Boiler Meter records simultaneously on one chart the steam flow from the boiler and the rate of air flow to the furnace for combustion. The air flow pen is adjusted to record coincident with the steam flow pen when the furnace is receiving the proper amount of air for maximum combustion efficiency.



WRITE FOR BULLETIN No. 420

REPUBLIC
INSTRUMENTS
AND CONTROLS

Republic Flow Meters Co.

2222 Diversey Parkway • Chicago 47, Illinois

*Corrosion

* This is the 10th of a series of informative messages concerning the meaning and significance of commonly used tests and terms employed to describe the characteristics of lubricating oils.

INDUSTRIAL TYCOL OILS-GREASES

OIL IS AMMUNITION
USE IT WISELY !

DRUMS! DRUMS! DRUMS!
War needs make it extremely important that all empty drums be returned immediately.

SCIENTIFICALLY ENGINEERED FOR EVERY INDUSTRIAL USE

TYCOL

TIDE WATER LUBRICANIA

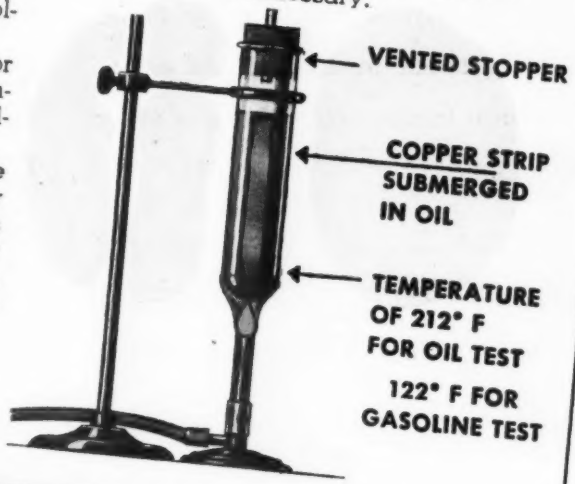
EXPLANATION: Petroleum products are frequently used in contact with metal, and when it is essential that the metal shall not be corroded, it is customary to require that the petroleum products pass an appropriate corrosion test.

TEST: The Copper Strip Corrosion Test as described in "Federal Specifications for Lubricants and Liquid Fuels" indicates the presence of free sulphur or corrosive sulphur compounds in undesirable quantities. It is conducted as follows: A clean strip of mechanically polished pure sheet copper about one-half inch wide and three inches long is placed in a clean test tube. Sufficient of the oil or liquid fuel to be tested is added to cover the copper strip completely. The test tube is closed with a vented stopper and maintained at a temperature of 212° F. for 3 hours. (If gasoline is being tested, then the temperature is held at 122° F. to avoid loss of product by distillation). The copper strip is then rinsed with sulphur-free acetone and compared with a similar strip of freshly polished copper.

The presence of free sulphur or corrosive sulphur compounds is indicated by the corrosion or discoloration of the test strip.

The sample does not "pass" the test if the discoloration of a freshly polished copper strip becomes opaque or if pitting is caused on any portion thereof. A slight discoloration is generally accepted as "passing" the test.

SIGNIFICANCE OF TEST: The Copper Strip Corrosion Test is an extremely sensitive test for indicating the presence of free sulphur or corrosive sulphur compounds in an oil. This test will detect concentrations of free sulphur as low as .001%. Variations in color of the copper strip may occur through a whole range of color shades with greens and reds predominating. Certain of these colors result from other reaction products than those caused by sulphur. These compounds may in no way be detrimental, and this fact should be taken into consideration when using this test to pass on the corrosive properties of an oil. Free sulphur colors the copper strip "black." The Copper Strip Corrosion Test is a desirable test for control of refining processes on certain types of petroleum products such as gasoline, Diesel fuel, Hypoid and All-Purpose Gear Lubricants, cutting oils and the like. It may also be used in the field for determining if sulphur compounds are present in certain oils containing additives when an active sulphur ingredient is necessary.



Tycol lubricants are made in a comprehensive line to meet each specific service requirement. Their repeatedly-proven ability to assure outstanding performance is the result of modern scientific manufacturing and rigid testing. Tide Water engineers will recommend the Tycol lubricant exactly suited to your needs – thus assuring truly efficient and economical lubrication.

TIDE WATER ASSOCIATED OIL COMPANY

MAKERS OF THE FAMOUS VEEDOL MOTOR OIL • Eastern Division: 17 Battery Place, New York 4, N. Y.

Principal Branch Offices: Boston, Philadelphia. Pittsburgh, Charlotte, N. C.

INDUSTRIAL LUBRICANTS

THESE TUBES HAVE BEEN PROVED

by more than 120,000,000

Republic ELECTRUNITE Boiler, Condenser and Heat Exchanger Tubes are not new products. Long ago they proved *CONCLUSIVELY* their safety, soundness, ease of installation and economy in service.

The first ELECTRUNITE Pressure Tubes were installed in 1932—and immediately began to establish records. Today, more than 120,000,000 feet have been installed in all types of steam generating and heat transfer equipment, in every kind of service.

Because of the advantages *CONSISTENTLY* afforded by the ELECTRUNITE process of manufacture, these tubes are unusually easy to install. They slide in readily—roll to tight joints freely and quickly—cut installation costs.

Their smooth, scale-free surface retards corrosion. Their uniform strength and the rigid tests made after every step in the ELECTRUNITE process assure positive safety in *EVERY* tube.

Companion products made by the same process—some 30,000 miles of Republic Line Pipe, 50,000,000 feet of oil well casing and tubing, and more than 1,000,000,000 feet of aircraft and mechanical tubing in carbon, alloy and stainless steels—also have added indisputable proof of the soundness, safety and economy of Republic Electric Weld Tubular Products.

Would you like to know more about ELECTRUNITE Tubes, how they are tested, where and how long they have been installed? Write us.

REPUBLIC STEEL CORPORATION
STEEL AND TUBES DIVISION • CLEVELAND 8, OHIO
Berger Manufacturing Division
Culvert Division • Niles Steel Products Division
Union Drawn Steel Division • Truscon Steel Company
Export Department: Chrysler Building, New York 17, New York

Republic
ELECTRUNITE
Reg. U. S. Pat. Off.
BOILER, CONDENSER AND HEAT EXCHANGER TUBES

BUY MORE THAN BEFORE IN THE FIFTH WAR LOAN

Feet in Service

FIRST LINE OF FIGHTING STEEL

Batteries of open-hearth furnaces in the steel mills of America produce most of the steel for the attack. For the open-hearths are the first line of steel production — and steel is the spearhead of invasion.

New skills and new methods in open-hearth operation contribute to the record-breaking steel production that arms our men and our allies and affords protection to their lives as well.

This greater open-hearth tonnage of new carbon steels, with properties approaching the alloys, holds high promise for peacetime application in great abundance that will enrich life and enlarge daily living.

JONES & LAUGHLIN STEEL CORPORATION
PITTSBURGH, PENNSYLVANIA

J&L STEEL

CONTROLLED QUALITY STEEL FOR WAR

THE OPEN HEARTHS

Bigger than 8-room house, a modern open hearth steel furnace, enclosed in silica brick, produces 150 to 200 tons of molten steel every 10 to 12 hours. The furnace is first charged with limestone, then scrap iron, eventually pig iron or molten iron, and other ingredients. For hours the "bath" melts, bubbling and boiling at temperatures up to 3,000°F., is worked, watched and tested by skilled crews, vigilant to maintain control of quality.

Samples of the steel bath are taken at intervals and laboratory tested to make sure analysis of the steel is correct for the job it is to perform—perhaps on a far away battle front. Experienced open-hearth melters and helpers, by merely looking at a fractured steel sample, can judge carbon content to within 2/100 of 1%. In this they are now assisted by a magnetic device in a small box which reveals carbon content on a dial. This is the "Carbanalyzer," a J&L invention.

Through tap hole in rear wall the "heat" of molten metal is drawn off into great ladles in pits below. As these are filled, protectively garbed skilled workmen on the tapping platforms amidst heat and sparks, throw in measured quantities of manganese, silicon and other final modifying ingredients (see illustration) to obtain exact analysis of steel desired.

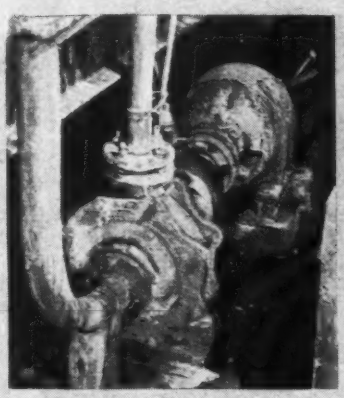
Wispy vapors tinted lavender, chartreuse, pink, blue, yellow, arise as the fiery stream of steel gurgles and splashes until ladle is full, and steel sparks shower about, popping and bouncing as they hit the ground. Overhead crane now picks up the sputtering brimful ladle and bears it away to fill the rows of ingot molds standing close by on low-built buggies (small flatcars).

Greatest steel producers of all time, open hearth furnaces, from which streamed last year in the U. S. 78,625,857 tons of steel ingots, were invented by Charles William Siemens, of Hanover, Germany, who became citizen of England to obtain protection of its patent laws. He patented his furnace in 1861 and perfected it in 1867, a dozen years after Henry Bessemer's process had revolutionized steel making.

Two brothers in France, Emil and Pierre Martin, experimenting in the 60's to further improve steel-making methods, utilized a Siemens furnace to produce steel by melting scrap iron in bath of molten pig iron. This became known as the Siemens-Martin process; is substantially the process used today.

A Cleveland ironmaster, Charles A. Otis, founder of Otis Steel Co., in association with Samuel F. Wellman, engineer, of New York, in 1873 built first complete steel works in U. S. planned exclusively for production of steel by the acid open hearth process. In 1880 Wellman built for Otis first basic open hearth steel furnace in U. S. (Basic differs from acid process.) Otis Works, Cleveland is now one of Jones & Laughlin's big steel plants—others are in Pittsburgh and Aliquippa, Pa.

DOSE OF SALT

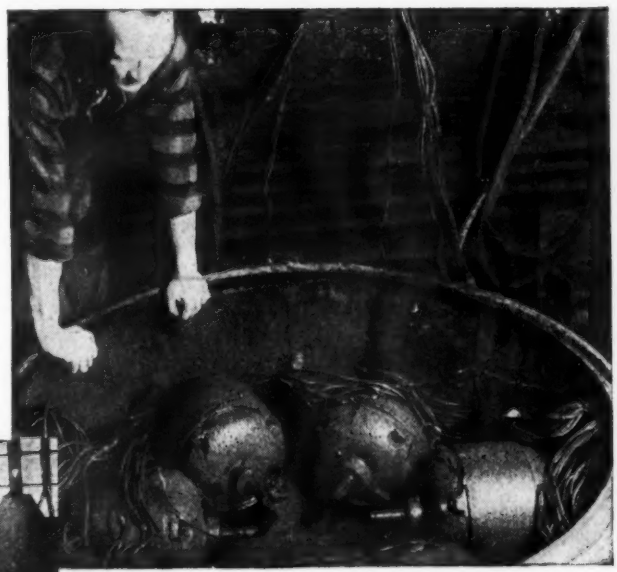


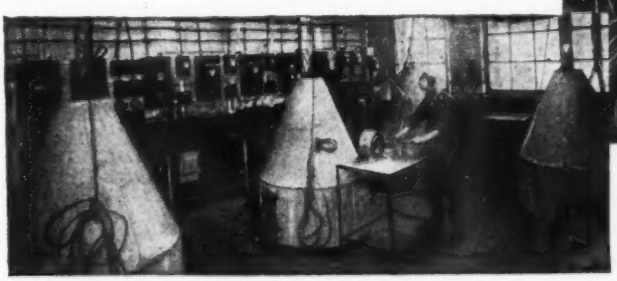
Encrusted with chemical salts, this Tri-Clad motor continues to drive a pump without breakdown of its insulation. In almost every industrial plant, motors are called upon to keep going under conditions which try their endurance to the limit. It may be in a plating room, or on an exhaust fan, or in a wet sub-cellar, or — as in this case — in connection with chemical processing. In emergencies, open motors may face conditions for which good engineering practice would require totally enclosed construction — conditions which tend to corrode the frame and attack the insulation. Endurance of Tri-Clad motors under such conditions results from tests like the one described below.

Salt-spray test of TRI CLAD motors gives assurance of long life in severe service

IN this accelerated life test to determine the ultimate endurance of their insulation, the motors are operated to failure under one of the worst possible combinations of conditions. They are continually exposed to a 2% salt-water spray, while operating on a duty cycle of 3 minutes on and 37 minutes off. (These repeated voltage surges impose greater stress on the insulation than would continuous operation.) Tests are run on all new insulations developed, and as a production check on motors taken at random off the assembly lines. Because of their endurance under this severe test, among others, Formex* wire and Glyptal* bonding material were chosen for Tri-Clad insulation.

*Reg. U. S. Pat. Off.





Left: Conical hoods cover the tanks in which these salt-spray tests are conducted.

GENERAL ELECTRIC

TRI CLAD MOTORS

Every week 192,000 G-E employees purchase more than a million dollars' worth of War Bonds.

Progress and Power in the TEXTILE

Perhaps no other industry is quite as dependent on low cost, dependable electrical energy as textile and rayon manufacturers. America's great Public Utilities have met all the requirements of this ever expanding group in widely scattered sections all over the United States.

American Blower engineers, too, have contributed much to the task of making rayons and cloth of all types at low cost. For many years American Blower fans, blowers, air conditioning units and humidifiers have been maintaining healthful, efficient working conditions in the plants of the textile and rayon industries.

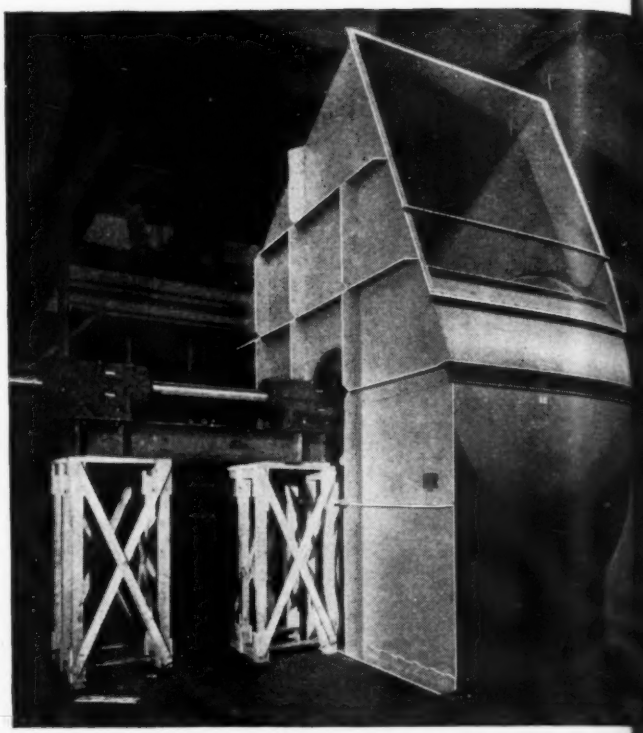
Furnishing vital equipment of standard as well as specialized types for handling of air in industry, and building mechanical draft equipment, dust collectors and fluid drives, is our job. May we co-operate with you?

MECH. DRAFT · AIR-CONDITIONING · FLUID DRIVES · DUST COLLECTORS
AMERICAN BLOWER

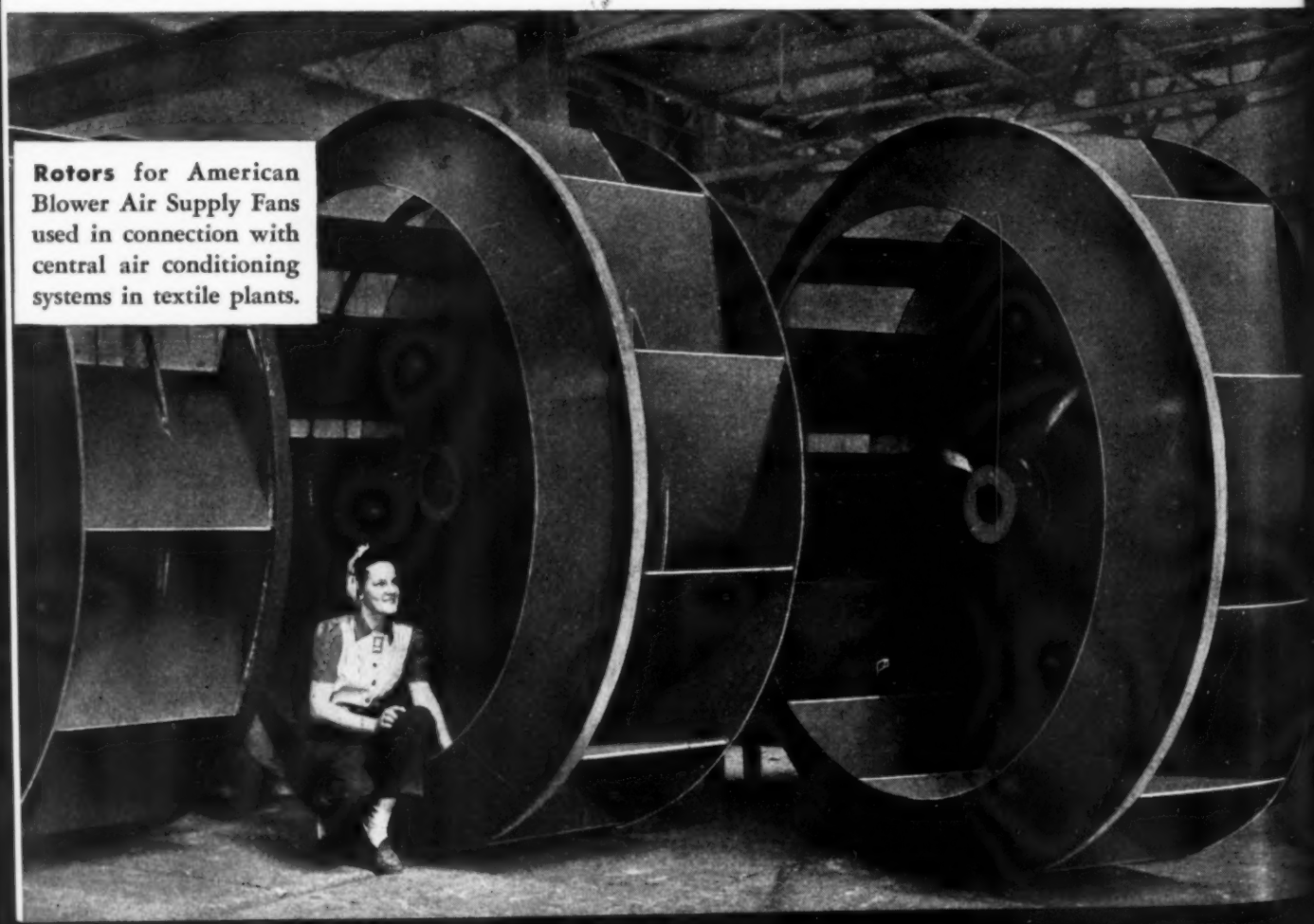
AMERICAN BLOWER

ARMY E NAVY
For Production "Well Done"

AMERICAN BLOWER CORPORATION, DETROIT, MICH.
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONT.
Division of American Radiator & Standard Sanitary corporation

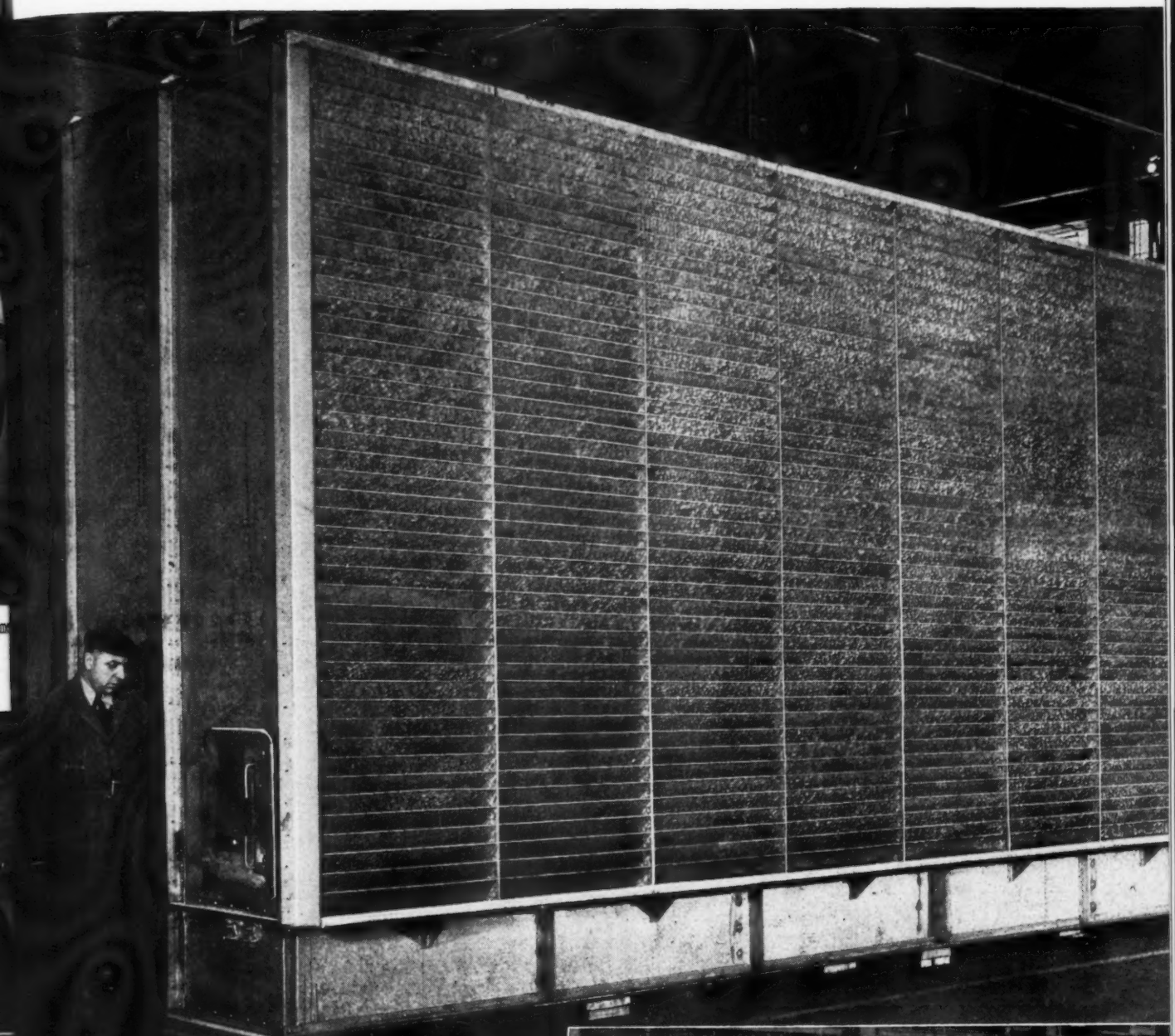


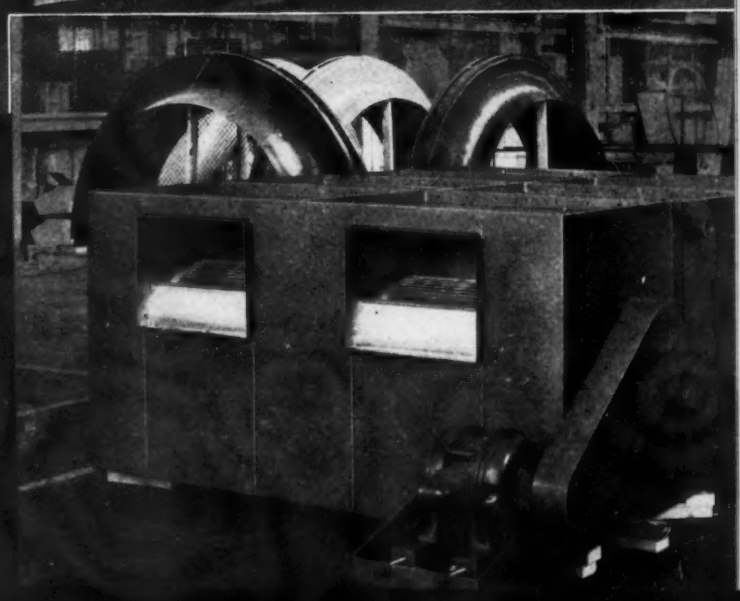
American Blower Fan for exhausting organic fum from spring room machines in a rayon plant.



Rotors for American Blower Air Supply Fans used in connection with central air conditioning systems in textile plants.

AND RAYON INDUSTRIES



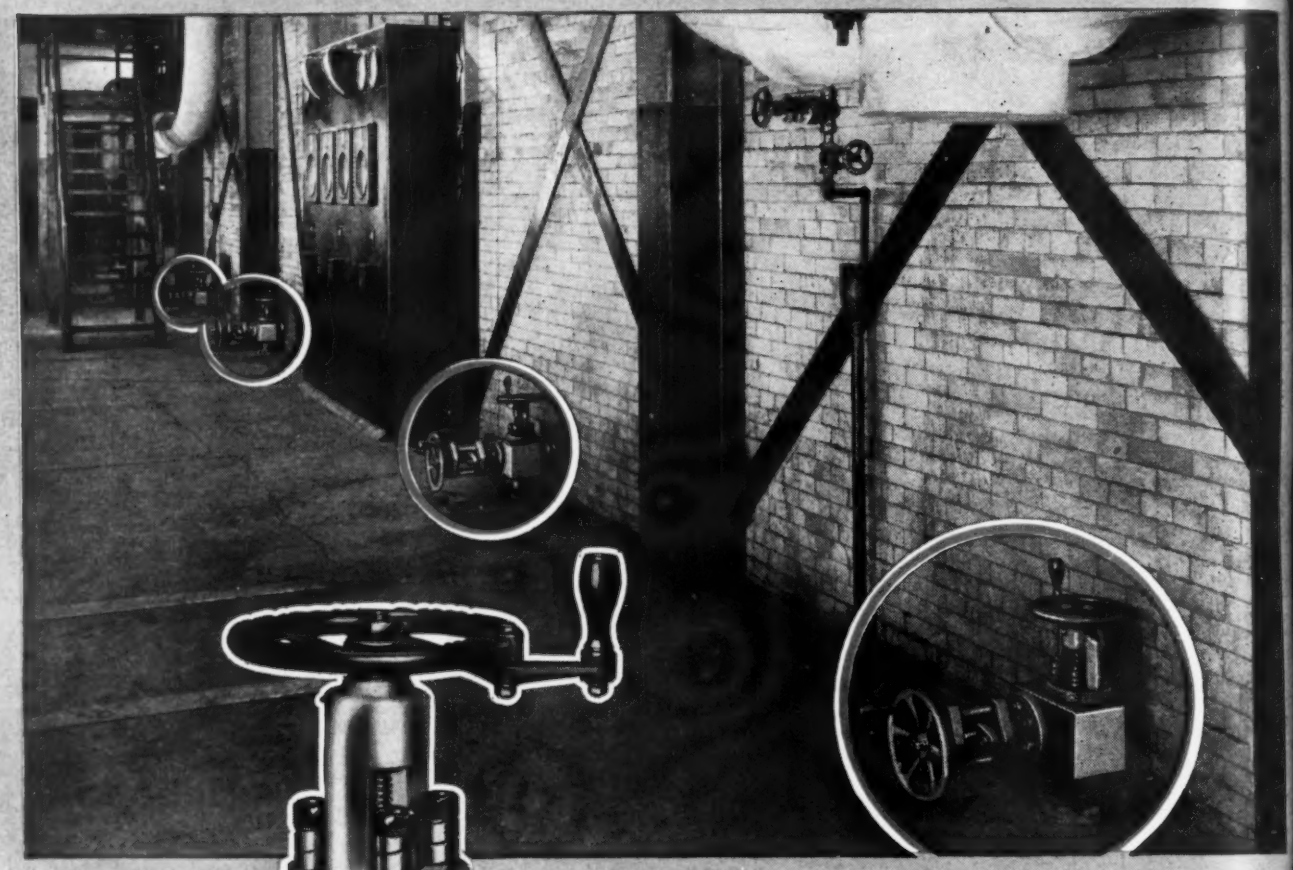


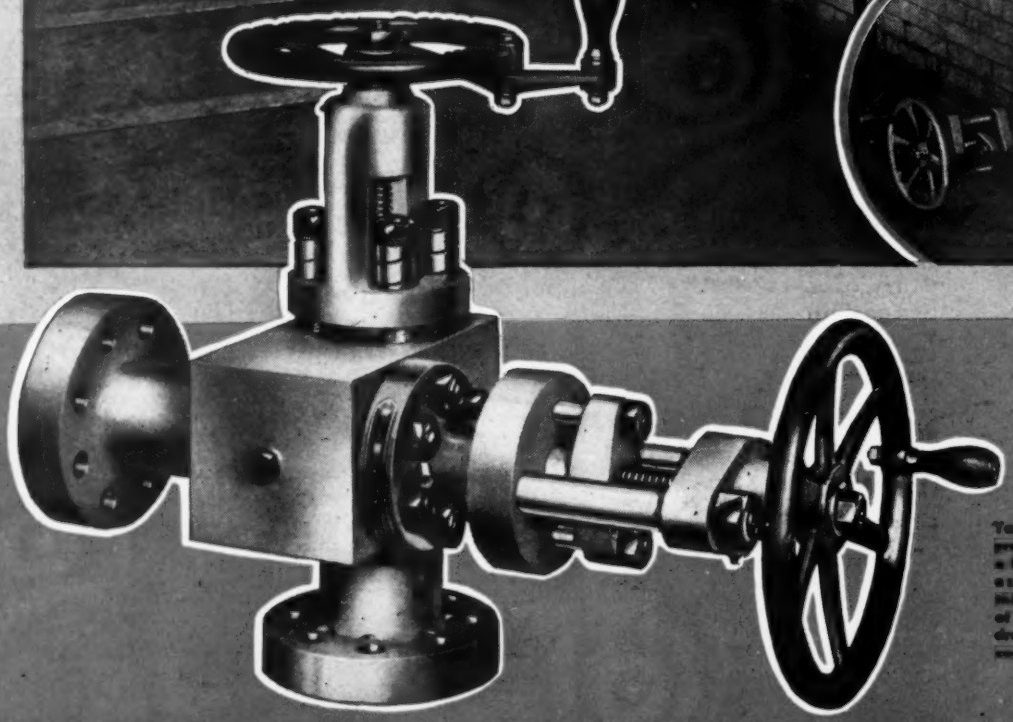
(Above) American Blower Central System Air Conditioner and Washer for a rayon plant.

• • •

(At Right) Air Conditioning and Humidifying unit built by American Blower for one of America's largest textile mills.

At TOLEDO EDISON
It's YARWAY





The New Yarway Unit Tandem Blow-Off Valves on the 800 lb Integral Furnace Boilers at Toledo Edison's Water Street Station.

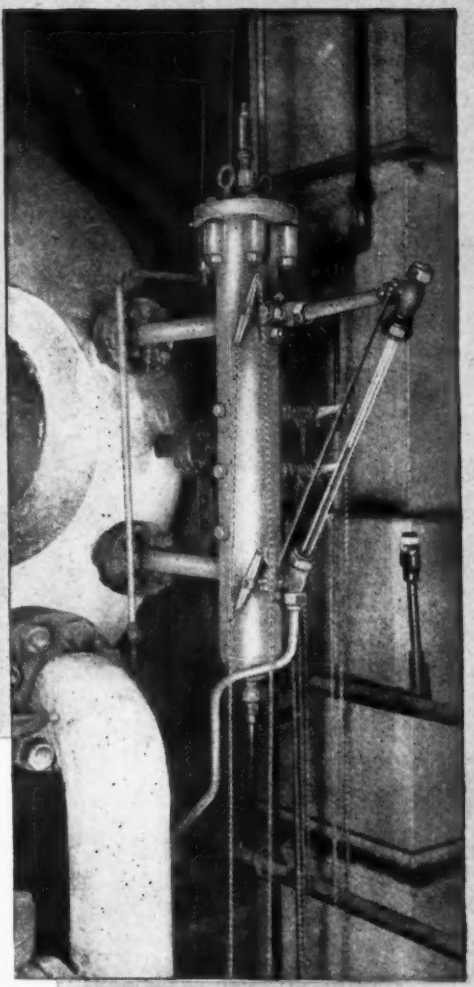
●

Yarway Unit Tandems are built for pressures up to 2500 lb. Combining a Hand-Seat and a Seatless Valve in a single, one-piece, forged steel body, this Tandem provides the advantages of both designs—for blowing or draining and cooling—in a single, compact, rugged unit.

YARWAY

Company All the Way

- **YARWAY UNIT TANDEM** *Blow-Off Valves*
- **YARWAY HI-LO ALARM** *Water Columns*
- **YARWAY SESURE** *Inclined Water Gages*



One of the Yarway HI-LO Alarm Water Columns and SESURE-Inclined Water Gages in use at the Water Street Station of the Toledo Edison Co. This station, temporarily operating on 200 lb pressure, selected Yarway water level indicating equipment for that pressure range—will replace with higher pressure equipment when plant is stepped up to design pressure of 800 psi.

Many years of favorable experience with Yarway Blow-Off Valves led Toledo Edison to select them for their first high pressure unit—Acme Station—back in 1937. Six sets of Seatless and Hard-Seat Tandems were used, followed again in 1940 by 12 sets of Yarway Unit Tandems, making this station 100% Yarway Blow-Off Valve equipped.

More recently, when the 800 lb Integral Furnace Boilers were purchased for the Water Street Station (illustrated), four more Yarway Unit Tandems were installed.

The reason why high pressure utility and industrial power plants, one after another, select Yarway Blow-Off Valves is to be found in such records of performance as —"still tight after 3000 blows at more than 1300 psi, without the replacement of a single part or repairs of any nature."

Yarway Valves "stand up and take" the most severe demands made upon them because they are the result of over a quarter century of mechanical and metallurgical research and field experience.

Get this insurance against blow-off valve trouble and expense and resultant costly power shut-downs.

Write for Catalog, Section B-431 for pressures from 400 lb to 2500 lb. Section B-424 for lower pressures.

YARNALL-WARING COMPANY
100 Mermaid Ave., Philadelphia 18, Pa.

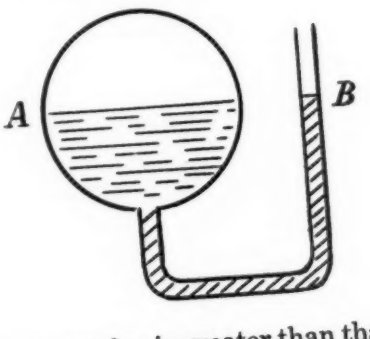
BLOW-OFF VALVES

Let's double-check the EYE-HYE operating *Knowledge worthwhile*

HYDROSTATICS 37

Manometers—*Differential Pressure*

The differential pressure manometer demonstrates the law of hydrostatics according to which liquid in a U-tube will show the surfaces at the same height in both vertical legs, if the pressures on the surfaces of the liquid in both legs are equal.



If pressure in one leg is greater than that in the other, the surfaces will be at different heights, the difference being proportional to the difference in the pressures and inversely proportional to the specific gravity of the liquid.

EYE-HYE's simplicity guarantees accurate boiler water level reading . . . essential to efficient supervision that maintains safety and economical power production.

60 Years of Boiler Protection

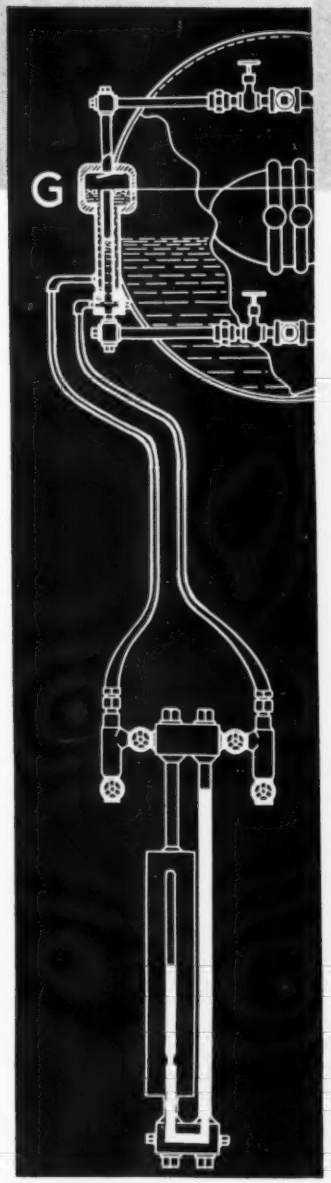
1884-1944

Reliance

Fundamentals...

rinciples easy to understand

or your future planning



Reliance EYE-HYE operates on the principle of the U-tube differential pressure gage or manometer. EYE-HYE itself forms the bottom of the U, while the flexible metal tubes connecting it to the boiler drum complete the two legs.

Condensation of steam in the special reservoir known as the Unitemp (see G in diagram at right) maintains a level of water in one leg of the EYE-HYE hookup equal to the predetermined maximum *high* water level in your boiler. As water in the boiler drum rises or falls it exerts a varying pressure on the opposite leg. Unitemp also assures accuracy by equalizing the temperature — and therefore the specific gravity — of the water in both legs.

Counterbalancing these two pressures is a high specific gravity liquid known as Vizzene which is introduced in the bottom of the U-tube. It is of a rich green color to provide an easily observed distinguishing indicator. Since this liquid will not mix with water, the water in the two legs pushes the Vizzene back and forth according to the difference in hydrostatic head pressure.

Thus the Vizzene is always in the same relative position between the two columns of water and becomes the visual indication of movement which gages the rise and fall of water level in the boiler with scientific accuracy. Each EYE-HYE is calibrated at the factory to suit your operating steam pressure (which determines the specific gravity of boiler water) and the vertical visibility of your boiler gage.

THE STILL-NEW IDEA of convenient location of the vital water gaging function — removed from the usually high and sometimes obscured water column location, and avoiding the dangers of uncertain or inaccurate readings — is a "must" consideration for your new or modernized plant. Be sure to write for EYE-HYE Bulletin 382-C.

OILER SAFETY DEVICES

THE RELIANCE GAUGE COLUMN CO.
Cleveland, Ohio

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Buy More War Bonds

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BATTERIES of Diesel-powered Tournapulls, dozers, scrapers, almost overnight transform the rough terrain of invaded areas into emergency landing fields.

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Regardless of size or type of service, operators everywhere are assured of continuous, full-power performance for longer periods between overhauls when their Diesels are lubricated with Texaco.

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More stationary Diesel hp. in the U. S. is lubricated with Texaco than with any other brand.

Texaco Lubrication Engineering Service is available to you through more than 2300 Texaco distributing points in the 48 States. The Texas Company, 135 East 42nd Street, New York 17, N.Y.

Lubricants and Fuels

FOR ALL DIESEL ENGINES

B[illegible]ELP WIN THE WAR BY RETURNING EMPTY DRUMS PROMPTLY

So much depends

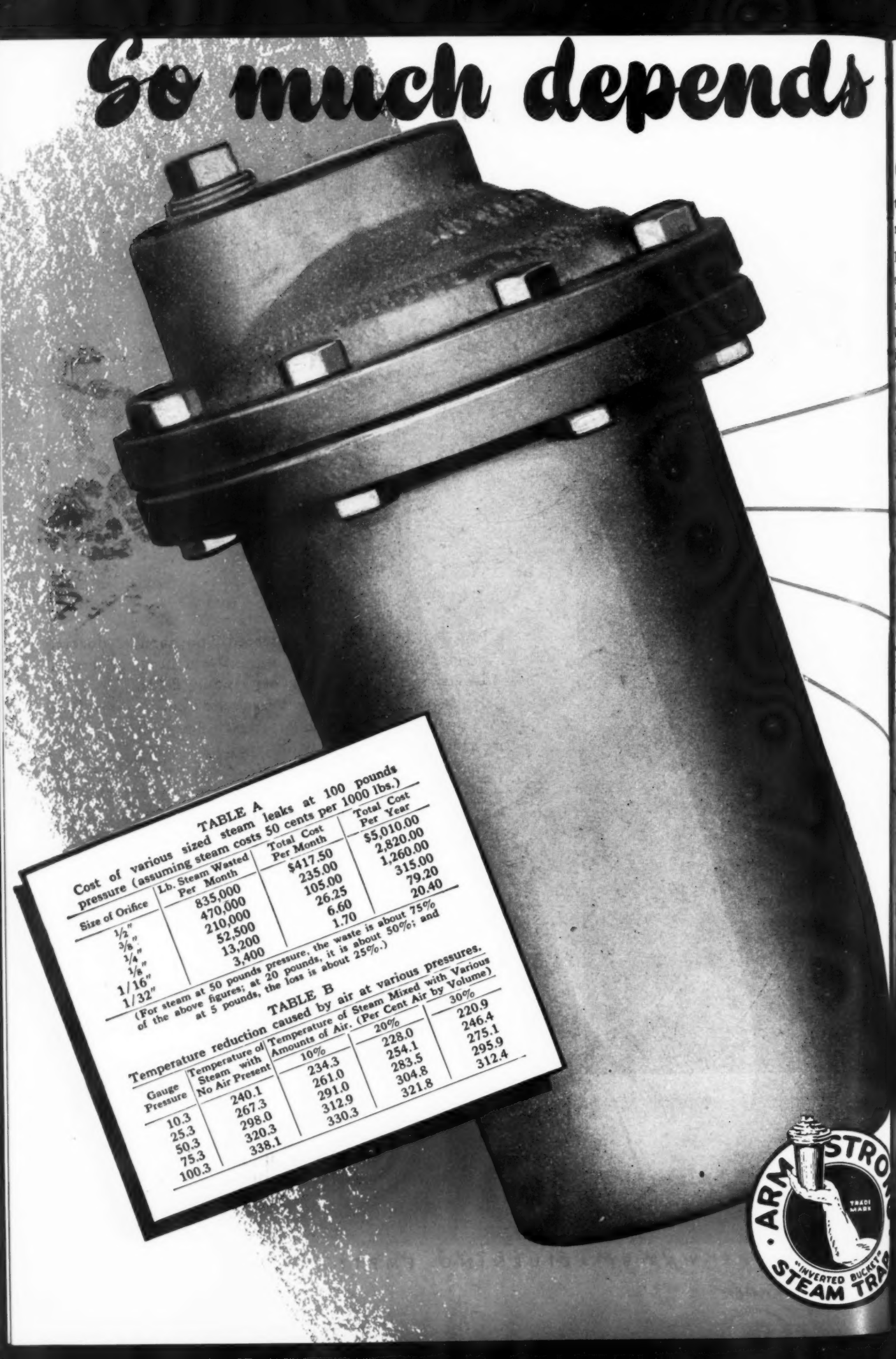


TABLE A

Cost of various sized steam leaks at 100 pounds pressure (assuming steam costs 50 cents per 1000 lbs.)

Size of Orifice	Lb. Steam Wasted Per Month	Total Cost Per Month	Total Cost Per Year
1/2"	835,000	$417.50	$5,010.00
3/8"	470,000	235.00	2,820.00
1/4"	210,000	105.00	1,260.00
1/8"	52,500	26.25	315.00
1/16"	13,200	6.60	79.20
1/32"	3,400	1.70	20.40

(For steam at 50 pounds pressure, the waste is about 75% of the above figures; at 20 pounds, it is about 50%; and at 5 pounds, the loss is about 25%.)

TABLE B

Temperature reduction caused by air at various pressures.

Gauge Pressure	Temperature of Steam with No Air Present	Temperature of Steam Mixed with Various Amounts of Air. (Per Cent Air by Volume) 10%	20%	30%
10.3	240.1	234.3	228.0	220.9
25.3	267.3	261.0	254.1	246.4
50.3	298.0	291.0	283.5	275.1
75.3	320.3	312.9	304.8	295.9
100.3	338.1	330.3	321.8	312.4

ARMSTRONG "INVERTED BUCKET" STEAM TRAP

on so little!

COAL, oil, metal, machinery, mining, manpower, transportation—all critical, and all go into the generation of steam. The most efficient utilization of steam and all that goes into it depends upon having it give up its heat where and when it is supposed to for productive use. Steam traps that remove all air and condensate and don't leak steam are perhaps the biggest single factor in insuring that steam, and all that goes into it, is utilized efficiently.

Air in a steam consuming unit can reduce heat transfer efficiency and steam temperature as shown in Table A. ARMSTRONG TRAPS AUTOMATICALLY VENT AIR AT A RATE OF 7 TO 10 CU. FT. PER HOUR AND 50 TO 100 TIMES FASTER IF EQUIPPED WITH A THERMIC VENT. Air collects at the top of the trap and is discharged along with condensate.

Steam leaks waste tremendous amounts of steam as shown in Table B. ARMSTRONG WATER SEALED TRAP VALVES ARE STEAM TIGHT — HEAT TREATED CHROME STEEL, GROUND AND LAPPED. They are immune to wire drawing and often stay steam tight for 5 or 10 years. They can be reground or replaced after long service in a matter of minutes.

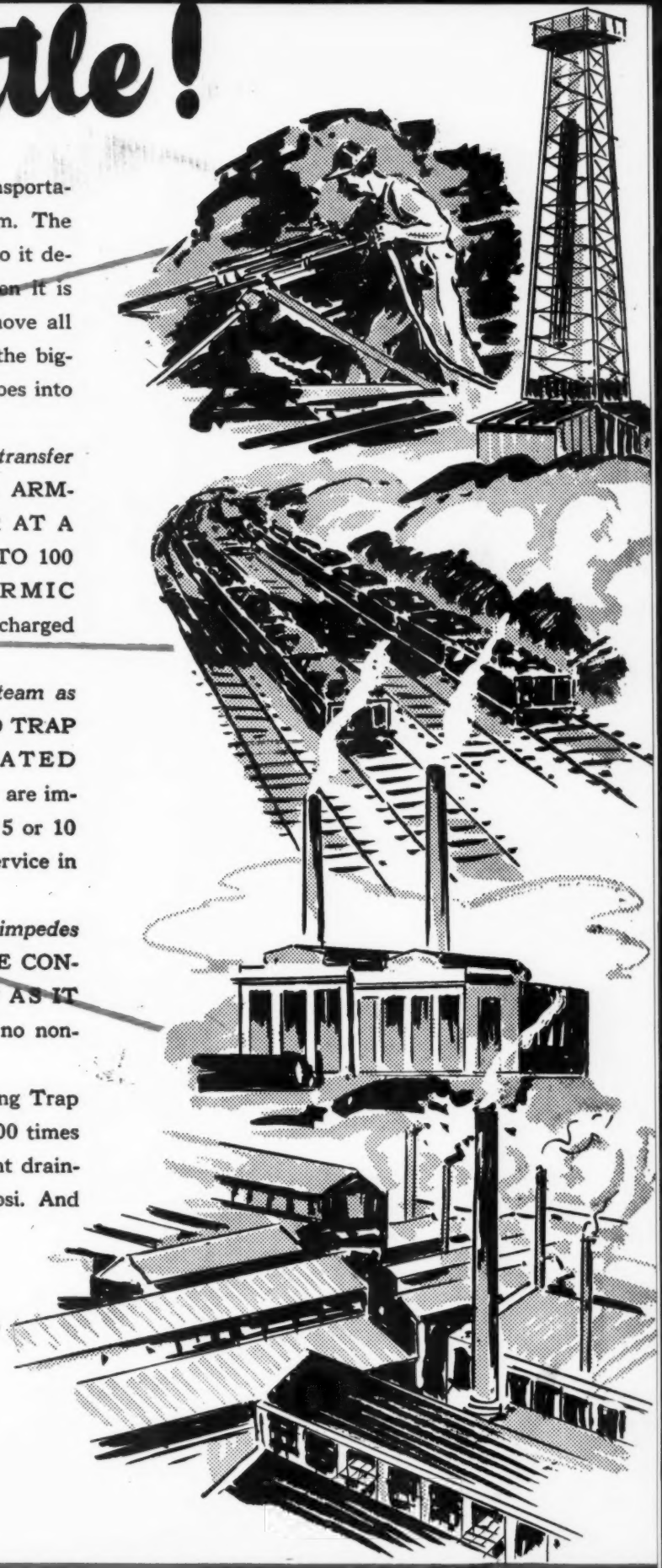
Condensate in a steam consuming unit obviously impedes heating efficiency. ARMSTRONG TRAPS REMOVE CONDENSATE *AT ANY TEMPERATURE* AS FAST AS IT ACCUMULATES. No cooling legs are necessary — no nonproductive radiation losses.

It has been estimated that one No. 813 Armstrong Trap would save 10 times its weight in boiler metal and 1000 times its weight in coal annually if it replaced one inefficient drainage device wasting 25 lbs. of steam per hour at 100 psi. And many a plant has many such a device.

Make the most of every pound of steam. Let an Armstrong representative survey your trapping needs. Write for his name today.

The Armstrong Trap Book will help you get better trapping. It gives complete data on traps, maintenance, installation, etc. Write for a copy.

Armstrong Machine Works
812 Maple Street, Three Rivers, Mich.

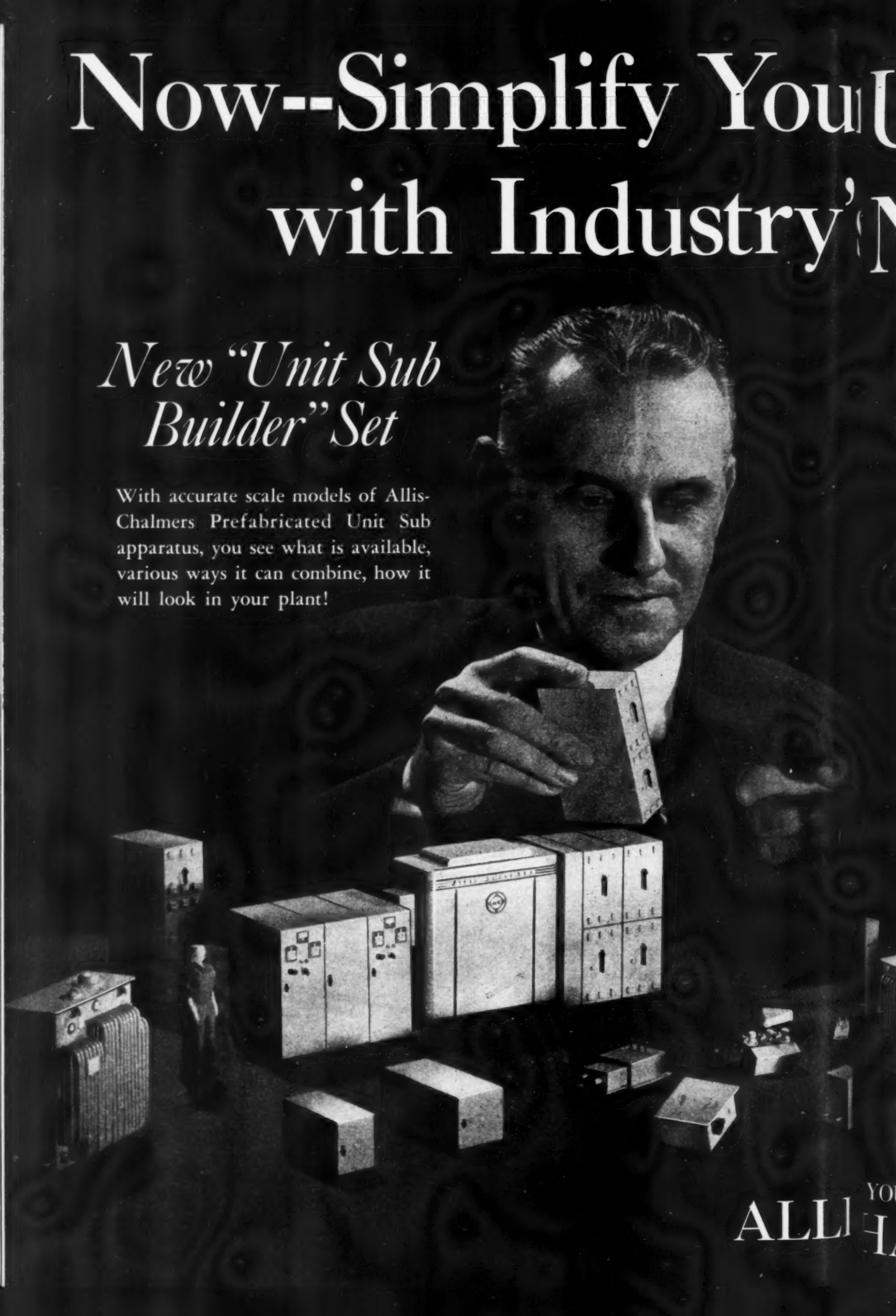


ARMSTRONG *Inverted Bucket* **STEAM TRAPS**

Now--Simplify You
with Industry'

New "Unit Sub Builder" Set

With accurate scale models of Allis-Chalmers Prefabricated Unit Sub apparatus, you see what is available, various ways it can combine, how it will look in your plant!



ALLI

Unit Sub Planning Newest Aid!

GUESSWORK IS GONE from unit sub planning when you *see* the elements of Allis-Chalmers Prefabricated Unit Substations — in accurate scale models.

You plan *visually*, effortlessly — without bogging down in charts, tables, diagrams — save time, cut way down on any chance of error.

To see for yourself how the new "Unit Sub Builder" Set can help you in your power distribution planning, call your nearby Allis-Chalmers district office.

An A-C field engineer will bring the models, together with the handy new "Unit Sub Slide Rule" for calculating breaker capacity — and new "Check List" for *double* checking all details. ALLIS-CHALMERS, MILWAUKEE 1, WIS.

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♪ *Tune in the famous Boston "Pops", Blue Network, Saturdays at 8:30 pm, EWT.*

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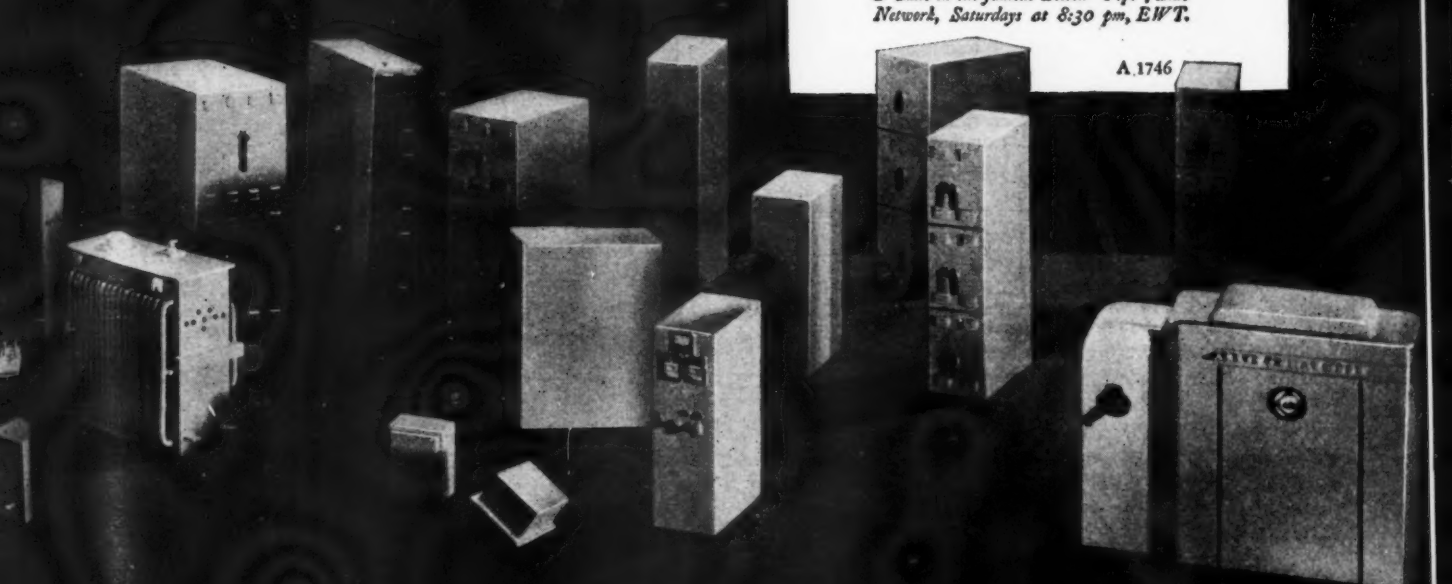

YOUR UNIT SUB IDEAS WORKED OUT WITH

ALLIS-CHALMERS *"Unit Sub Builder" Set*

How to tube a heat exchanger for new high temperatures ... new high pressures

If you were to look inside the feedwater heaters of the latest high pressure power plants, you would see how one of the major problems of high temperature–high pressure operation was solved in constructing these units.

The problem was to find tubing material that could withstand higher temperatures and higher pressures than had ever been tried before.

The tubing had to be stronger at elevated temperatures. It had to be corrosion-resistant to maintain a smooth surface and prevent accumulation of sludge and salt deposits. It had to have good heat-transfer properties. It had to be hard and tough to resist erosive wear. And it had to be ductile, so that it could be readily expanded into tight head connections.

In checking over possible materials, three groups of engineers, working independently on this problem, came out with the same answer: *Monel has the combination of properties necessary to meet the requirements.*

★ At the Twin Branch plant of Indiana and Michigan Electric Company, subsidiary of the American Gas and Electric Service Corp., Monel tubing was installed in a pre-heater handling 550,000 pounds of water an hour at 3200 pounds pressure per square inch—under external temperature of 637° F.—feeding a boiler operating at 2500 pounds steam pressure!

★ In Providence, R. I., the Narragansett Electric Company put one new high pressure boiler to work generating three times the power formerly obtained from eight low pressure units ... using Monel tubing under external heat of 700° F., internal pressure of 1300 psi.

★ In the Oswego plant of the Central New York Power Corp., Monel heater tubing was installed to operate under 2000 pounds water pressure, at an outside temperature of 770° Fahrenheit.

Recently, these installations were examined after 3 to 4 years' service and their performance has confirmed the choice of Monel as a practical answer to the problem—the Monel tubing was still operating perfectly.

If you are considering the installation of high temperature-high pressure equipment, here is one problem that has already been solved for you. For a more complete discussion of the problems encountered and overcome in the Providence, Oswego and Twin Branch installations, write for a reprint of the article "27 TIMES THE POWER OUTPUT ..." It includes the table of maximum allowable design stresses for non-ferrous materials taken from the new A.S.M.E. Boiler Code, and additional information about Monel heat exchanger tubing.

THE INTERNATIONAL NICKEL COMPANY, INC.
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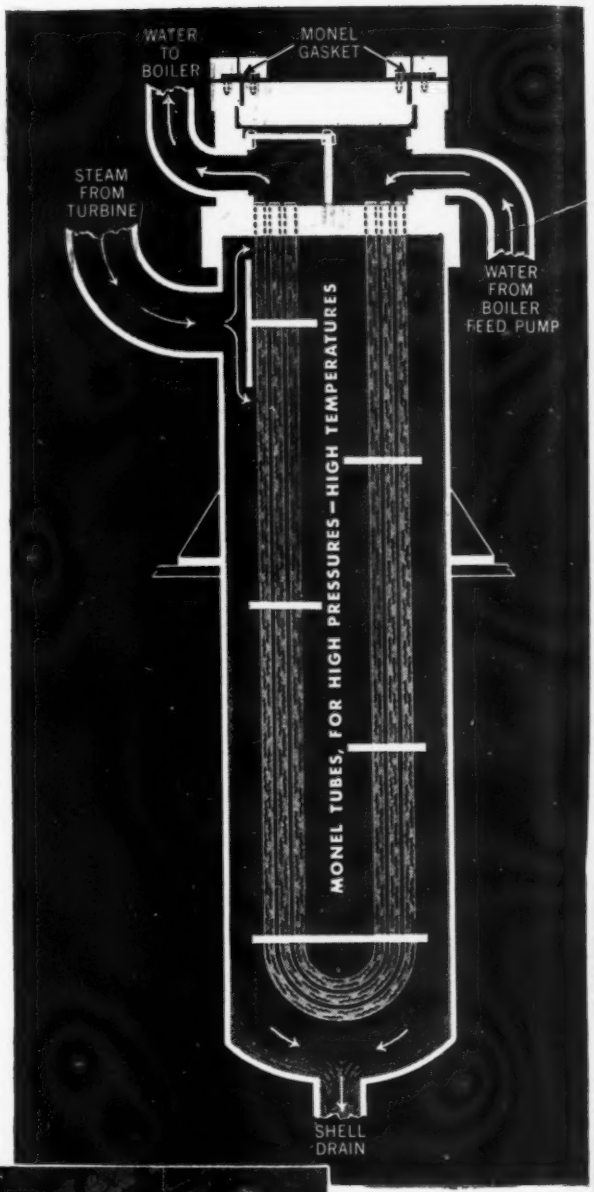

EXPANDING TUBES into the head of a pre-heater at Twin Branch. The excellent working properties of Monel are here in evidence. Monel tubing is ductile...can be expanded into snug-fitting durable connections with the head.

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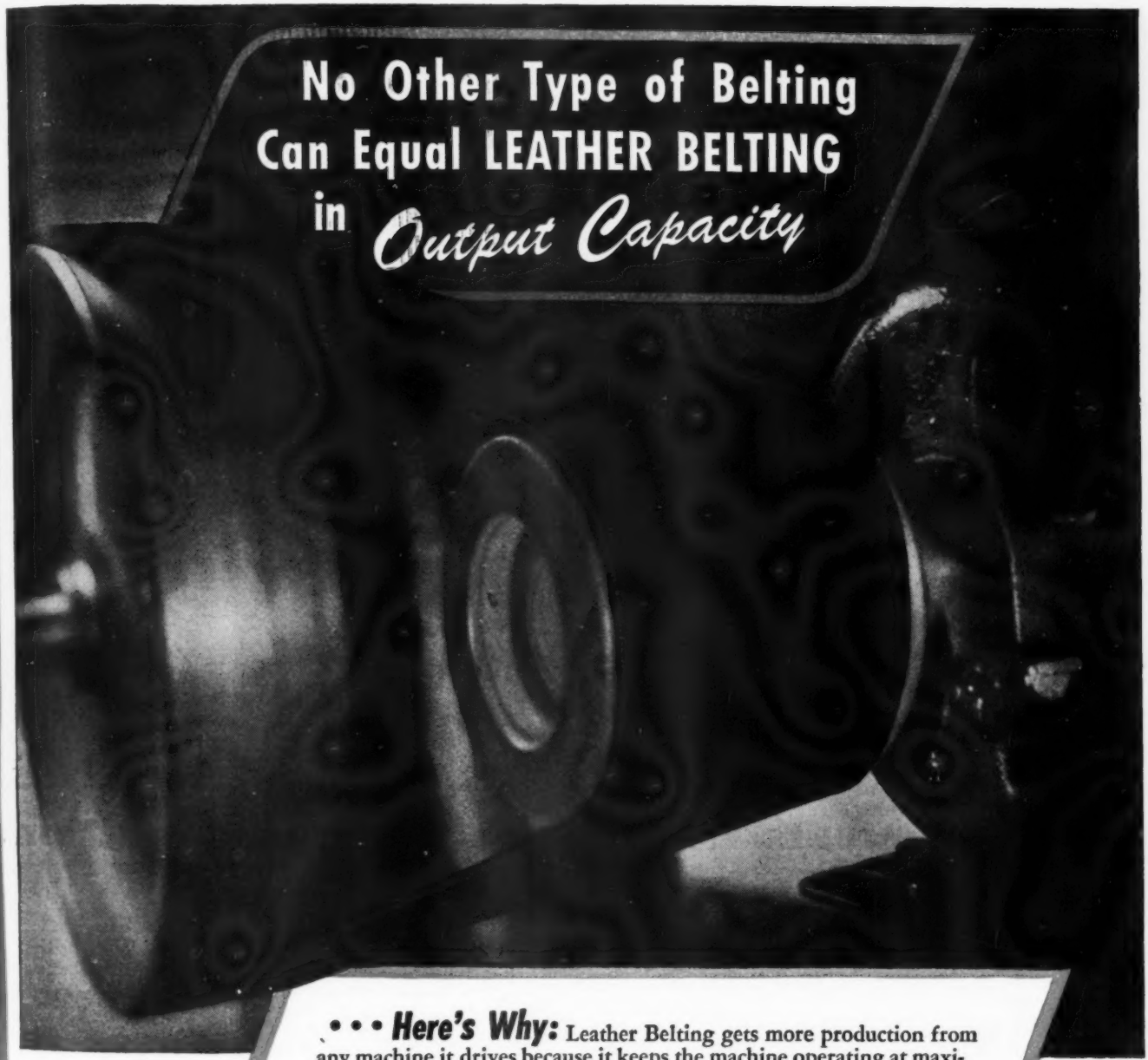

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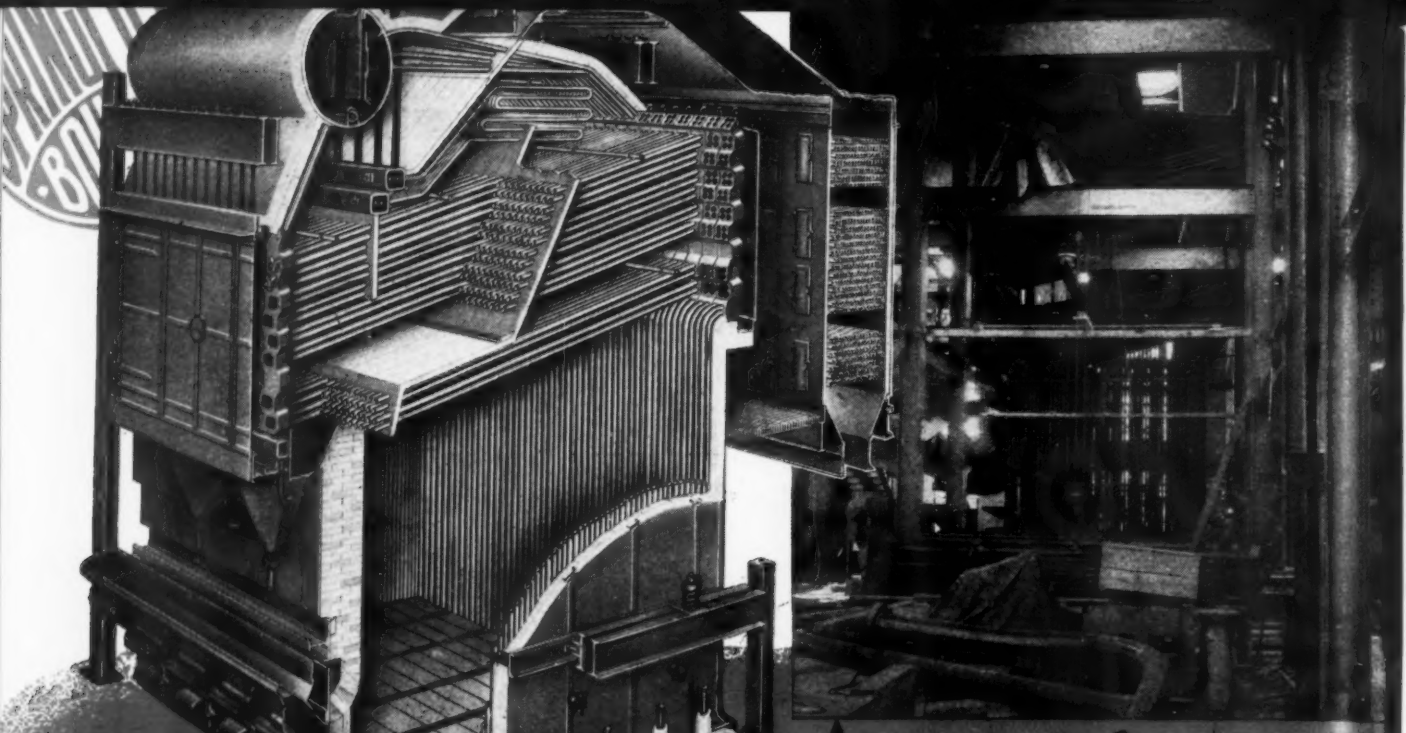

Sectional header...

CROSS-DRUM BOILER

...meets wide range of local conditions

THE sectional header, cross drum boiler, as designed and built by Springfield is widely favored for manufacturing plants as well as central station use.

One reason for this is that the Springfield variation of this type of boiler is flexible enough to be economically adapted to a wide range of fuels, water, space, load, and other local conditions.

Operating reports, on a wide range of fuels, show that Springfield units develop unusually high efficiencies as proved by low exit gas temperatures; through using smaller tubes, staggered tube groupings, permanently tight baffle construction, and well integrated overall design.

"Less outage for maintenance" is a common comment on Springfield installations. Controlled circulation with delivery to the steam drum above the water level gives this boiler ability to produce dry steam and handle rapidly changing loads. Water conditions should be carefully controlled in any modern boiler plant but this type of boiler is less sensitive and affords additional protection when water conditioning "slips". Larger and fewer handhole openings reduce the time and cost of cleaning, inspection and repair. Soot and ash cannot lodge on headers and drums. All parts are readily accessible.

In replacing obsolete boilers, it is often desirable to install larger capacity units without extensive building changes. Springfield boilers are lighter and more compact than other designs, and are readily adaptable to restricted space requirements. Pitch of tubes may be varied from 15 to 25 degrees to suit local conditions. High capacity water walls increase furnace capacities.

Because of factory assembled sections and single drum construction, from 30 to 60 days are saved on erection time. Less brickwork is required, and cross tube baffles are delivered in place. Complete drawings and patterns are available to produce duplicate units of many of the great number of modern Springfield generating plants built in recent years.

★ ★ ★

Springfield boiler installations range from 5,000 to 450,000 lbs. per hour capacity; and from 75 to 750 psi pressure. Contracts taken for complete steam generating units. Write for information. **SPRINGFIELD BOILER CO., 1953 E. Capitol Ave., Springfield, Ill.**

SPRINGFIELD

STEAM GENERATING UNITS

SPRINGFIELD BOILERS

ANY SIZE ANY FUEL ANY PRESSURE

It "Grips like Magic" to Give you faster, safer, better Mounting!

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YOU get smoother running performance with "Magic-Grip" because . . . its positive clamp fit grips motor and machine shafts uniformly, eliminating back-lash and shear.

Vibration and stress resulting from shaft overhang are greatly reduced, too, since new design allows the sheave that "grips like magic" to be mounted closer to motor. Motor bearing life is lengthened.

Allis-Chalmers' new "Magic-Grip" sheaves are stocked in a complete line *at no increase in price.* Now, more than ever, it pays to make Allis-Chalmers your "V-Belt Drive Headquarters."

For full data, ask our district office or dealer for bulletin B6310. ALLIS-CHALMERS, MILWAUKEE 1, WIS.

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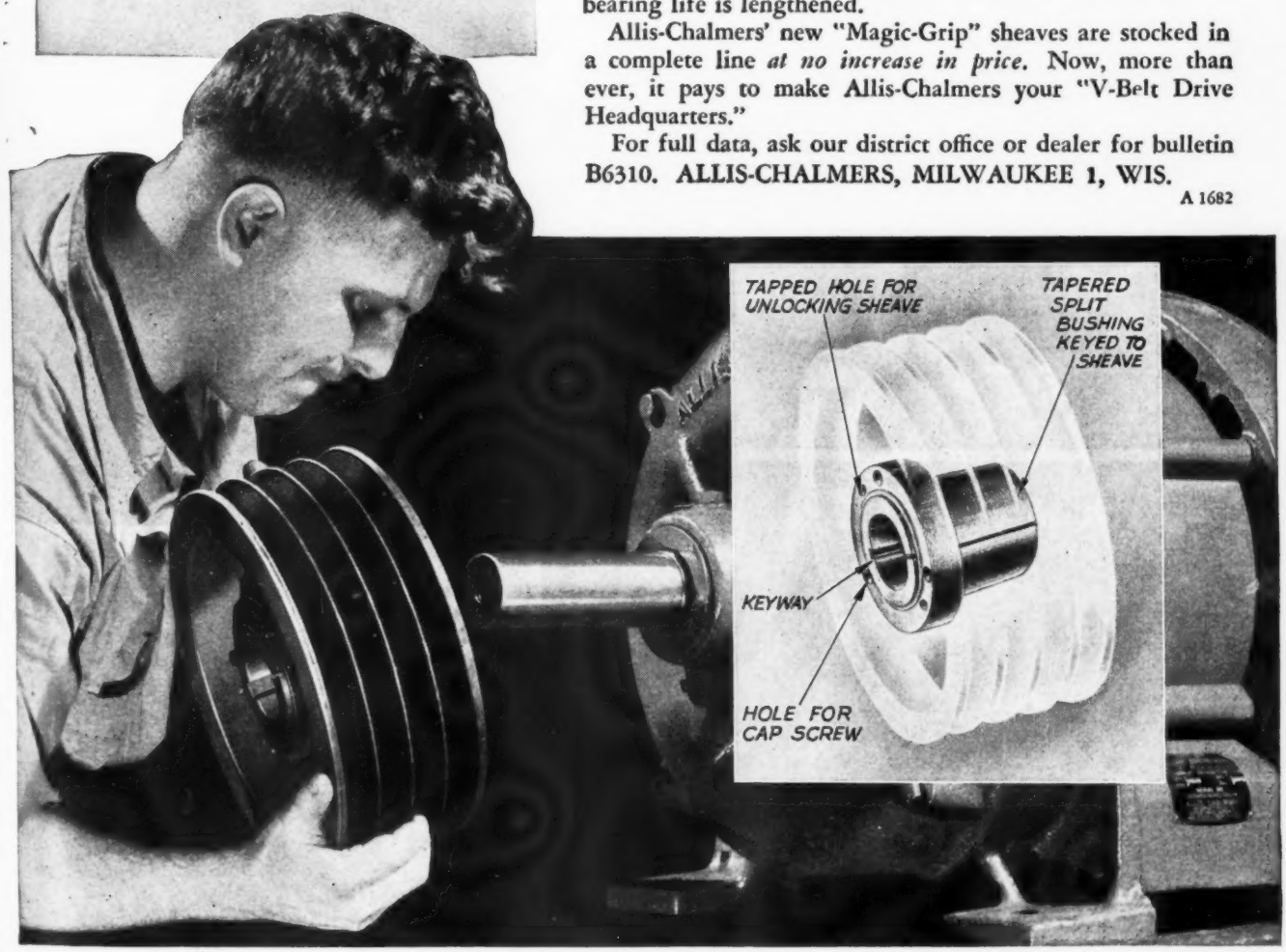

Allis-Chalmers Texrope "MAGIC-GRIP" SHEAVES

Backing up the field engineer is a staff of Hall water specialists whose combined knowledge has helped to solve the toughest problems of scale, corrosion, silica deposition, carryover, embrittlement and numerous other boiler ills.

6 years of unfailing power. The Hall Field Service Engineer has just finished his periodic inspection of an old boiler which has been kept in service continuously—without forced shut-downs—for six years. This is the kind of service you can expect from Hall preventive care.

HALL SYSTEM *of Boiler Water Conditioning*

How HALL "Preventive Care" gives new life to old boilers

MANY a power plant engineer is fondly nursing boiler equipment these days which only a few years back seemed to have earned deserved retirement.

One thing alone is responsible for the valiant performance of these "old-timers" —the progress that science has made in keeping a boiler "fit" and on the job— the knowledge that has enabled these plants to put their boilers in shape and *keep them there.*

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Important in these operations is the personal assistance of the Hall field engineer. Most important, too, is the complete support of the finest equipped and staffed laboratories in the world devoted exclusively to research in and the solution of water conditioning problems.

No longer need you worry over the destructive inroads of scale, corrosion, embrittlement and carryover, the constant deterioration arising from water conditions. In thousands of plants the modern practice of preventive care is keeping them under control. It could do as much for yours.

For more than 20 years Hall scientists have been the authoritative leaders in the field of boiler water conditioning. Out of this experience and through their research has come a system of preventive care which is standard practice in important power stations throughout the nation. May we tell you more about it? We'll gladly send complete information or a Hall representative.

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Hall Service in a Nutshell:

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5. Prevents corrosion in boilers and associated equipment.
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The extra strength built into these tough bronze valves comes in good stead in withstanding the punishing demands of continuous operating schedules. The simplicity of design and precision interchangeability of parts makes servicing easy, speeds maintenance.

Figures 2125 and 2129 (illustrated) are typical examples of Lunkenheimer correct engineering—carried through in a complete line of bronze, iron and steel valves, for all prevailing pressures and temperatures. Catalog available on request.

Lunkenheimer products are available from distributors everywhere. One of these distributors is near you to assist you with your maintenance and operating problems. His complete facilities and wide experience are at your call.

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GATE VALVES

Fig. 2125
125 lb. S.P. Bronze Gate
Double Disc, Rising Stem

Fig. 2129
125 lb. S.P. Bronze Gate
Wedge Disc, Non-Rising Stem

Here's a Handy Feature...

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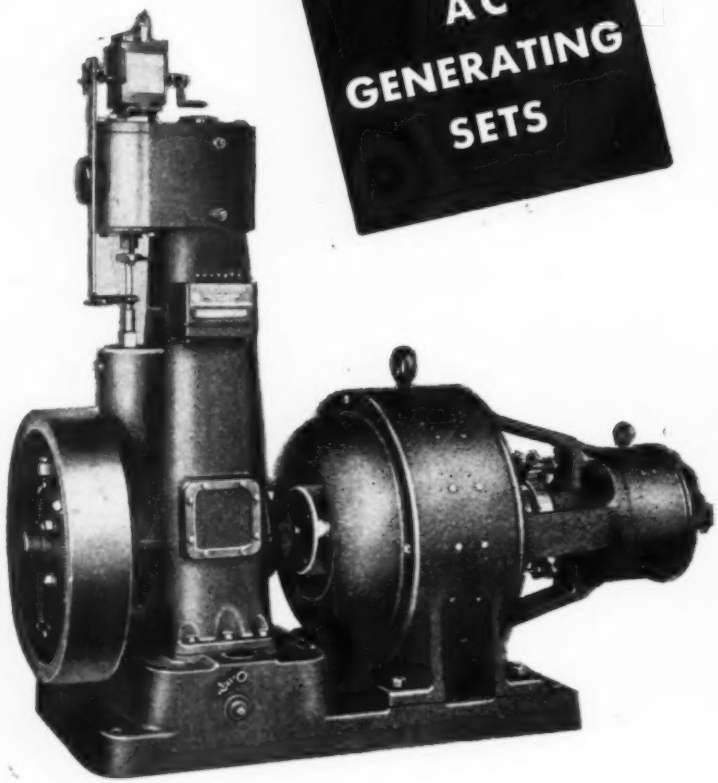

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(1) for plants equipped with DC motors

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STEAM ENGINES
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GENERATING SETS

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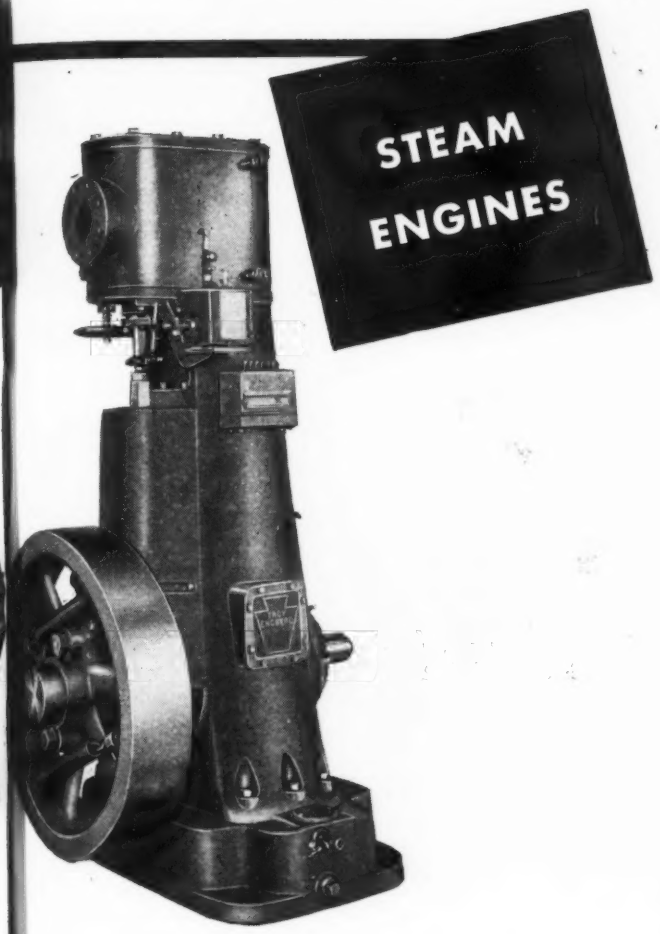

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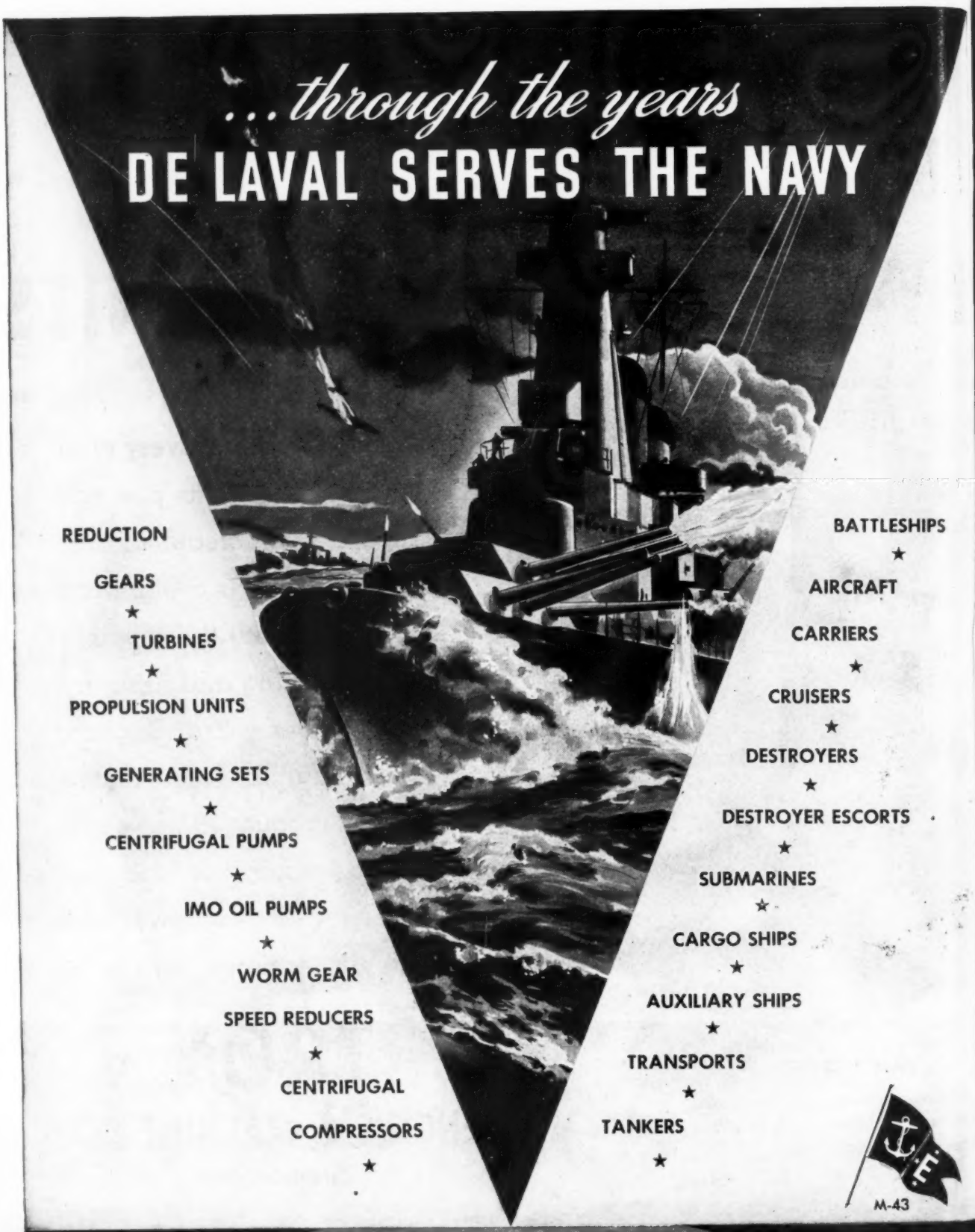

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STEAM GENERATION, FUELS, FIRING AND COMBUSTION
TURBINES, ENGINES, AUXILIARIES; HYDRO POWER
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PIPING, VALVES AND SPECIALTIES
TRANSMISSION, LUBRICATION
STEAM SERVICES, HEATING
INSTRUMENTS, CONTROLS
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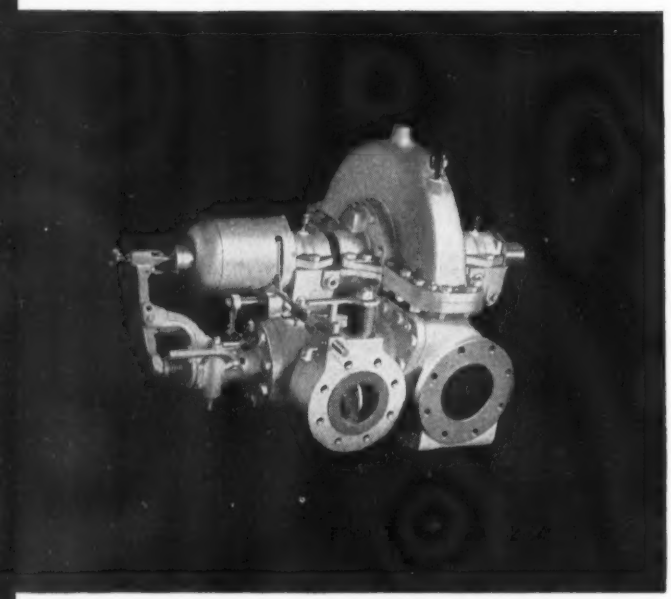
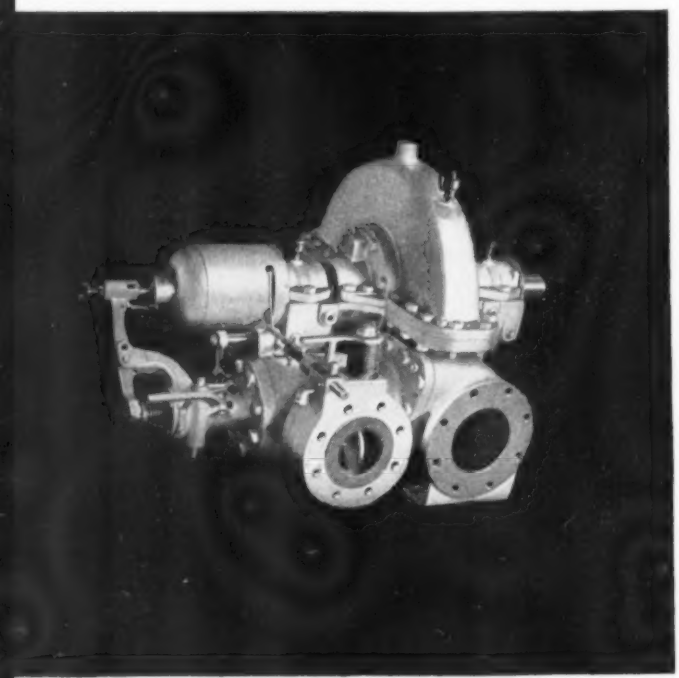


Type C-14 Single-stage General-purpose Turbine. Built for service at 5 to approximately 200 hp; speed range 1000-5000 rpm. Suitable for use with steam pressures through 600 lbs. gauge, and for total temperatures through 750° F.



Type C-20 Single-stage General-purpose Turbine. Built for service up to approximately 600 hp; speed range 1000-5000 rpm. Suitable for use with steam pressures through 600 lbs. gauge, and for total temperatures through 750° F.

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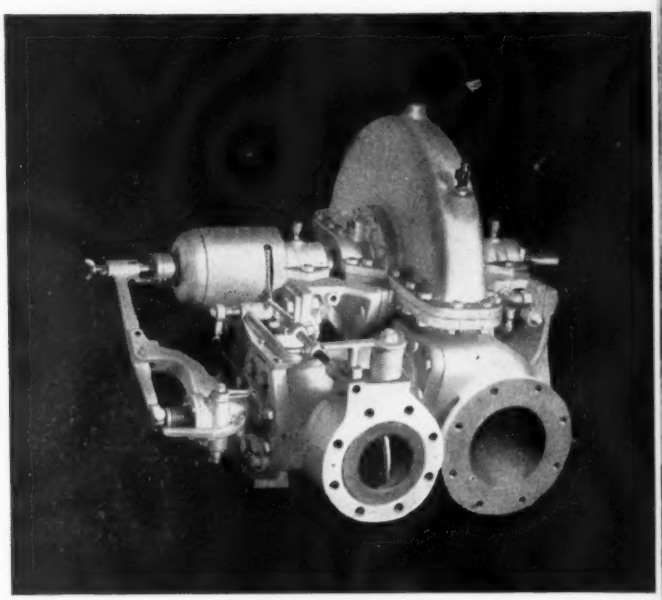
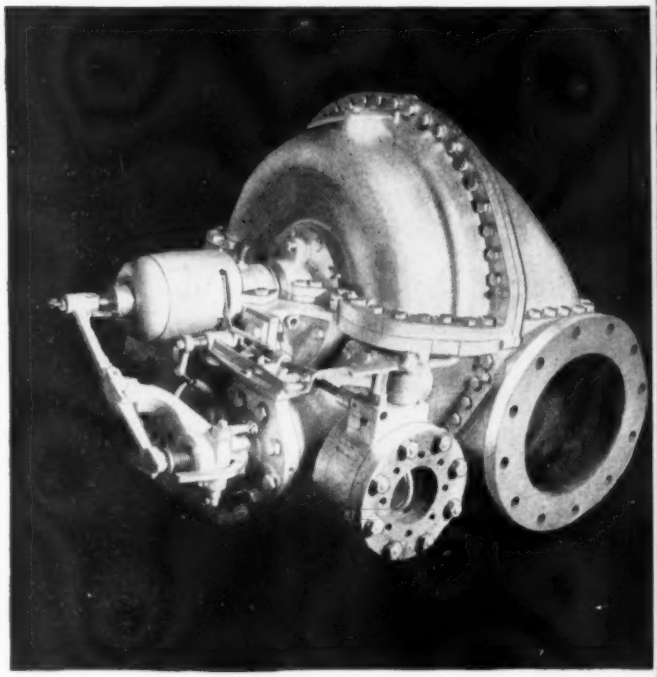


Type C-25 Single-stage General-purpose Turbine. Built for service up to approximately 1200 hp; speed range 1000-5000 rpm. Suitable for use with steam pressures through 600 lbs. gauge, and for total temperatures through 750° F.



Type C-225 Two-stage General-purpose Turbine. Built for services through approximately 1500 hp; speed range 1000-5000 rpm. Suitable for use with steam pressures through 600 lbs. gauge, and for total temperatures through 750° F.

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*with BYERS WROUGHT IRON coils

"To be continued" is written at the end of a lot of industrial construction today; this plant office building of the Layne-New York Company is a typical example.

A *two* story office was planned, but at the moment building restrictions limited construction to one, in which Byers Radiant Heating was installed. But with real foresight, the engineers also placed Byers Wrought Iron Pipe Coils for heating the future *second* story on the roof-deck, and embedded them in a 4-inch concrete slab. The slab was then covered with tar paper and cinder roofing. When conditions permit construction of the second story, the radiant heated floor will be ready and waiting.

You are probably called in as a consultant, a designer, or an installer of heating for any new construction around your plant, and this may be an idea you can profitably apply. Radiant Heating has been utilized in a number of industrial applications, and the users are among the most enthusiastic boosters of Radiant Heating.

It is probably unnecessary to point out to you the importance of using a material of proven dependability in services like this. Byers Wrought Iron has been used for years in similar services, and its durability is a matter of engineering record. In addition, it can be readily fabricated; its high heat emission can be verified by consulting an engineering handbook; and its coefficient of expansion and contraction is almost identical with that of concrete and plaster. This eliminates internal stresses that might crack floors or cause loss of bond.

We have prepared a "Case Study" on one industrial application, which you should find very interesting reading. We will be glad to send you a copy. Ask, also, for our technical bulletin, "Byers Wrought Iron for Radiant Heating Installations," which presents complete information on design and calculation.

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POWER

PHILIP W SWAIN, EDITOR • JUNE 1944 • ESTABLISHED IN 1882

Power to Burn

THOSE WHO WORRY about the future of electric power demand in this country should consider the fluorescent lamp—an object lesson in kilowatts and Americanism.

Here was a new form of lighting—so efficient a few timid souls in the power field viewed the glowing tube as an insidious device for illuminating America with fewer kilowatts. It used only half as much power for the same light.

This, of course, was nothing for red-blooded American consumers to worry about. They liked the new lamp—its operating economy, its style and its novelty—and they went after it hell-bent-for-election.

Anybody who figured that normal Americans would swap the old lighting for the new on the basis of the same levels of illumination simply didn't understand his fellow countrymen. Their habits were written plain enough in the history of the automobile. Remember? People once rode in trains or buggies, or walked. Then along came this easier and cheaper way to travel a mile. Did Americans use the new time-and-dollar saver to *reduce* travel time and travel budgets? They did not. They began to spend more than ever on transportation. They stepped on the gas, and saw the world.

Just that happened with fluorescent. The new lamp halved the energy cost of a given illumination level. Yet most of the stores and factories that changed over consumed *more* power for lighting. The typical job used fifty per cent more kilowatts to produce three times the light—a Yankee trade that paid dividends in better production and fewer rejects in the factories, and happier customers in the stores.

Except for the war-production plants, the war dammed up this torrent of lighting conversion. Some day peace will lower the barrier, and the wave of modernization will sweep on again into the still untapped market — 100,000 factories, 1,200,000 stores, 200,000 schools, 300,000 eating places and countless homes. The figures are from the paper Tom Fort of Westinghouse presented before the Missouri Valley Electric Association in April.

It's a safe bet, then, that lighting load will grow amazingly, but lighting alone cannot establish new highs for utility kilowatts and kilowatt hours. How about other loads, most of which cannot possibly show any such gain in utilization efficiency as the fluorescent lamp? What will be the big inducement to increased consumption? The answer is that *every* use of electricity (except war production) will skyrocket for the simple reason that electricity will be cheaper than ever before, measured in terms of the general postwar level of prices and wages.

Just as cheaper city water spells deeper baths and more lawn sprinkling, so the new popular-priced kilowatts will get themselves new jobs by the millions. Homes will use more power gadgets, more irons and water heaters. High labor cost and low kilowatt cost will accelerate industry's long-term trend to more power per machine and per worker.

Then a lot of new energy-consuming devices will begin to make hay. Mr Fort's list includes these: small electric steel furnaces for community service—resistance furnaces for bright annealing and bright hardening—high-frequency heating for brazing, heat treating, hardening, melting, sintering, metal bonding, paint drying —high-frequency dielectric heating to bond plywood, dry glue, sterilize grain and cook—arc and resistance welding—electrostatic air cleaning and spray painting.

Most load statisticians agree that it won't take long for these and other gains to offset lost war-production kilowatts when peace comes. That means fair weather ahead for those whose livelihood is tied to the production of power, the building of power plants or the manufacture of power equipment. And it means another great demonstration of the American philosophy—higher living standards for all through better machinery, more power and the unfettered spirit of free enterprise.

POWER Speeds Rehabilitation

Mobile plants on rail cars can quickly move into devastated areas. W N Oberly, General Electric, describes the 3000-kw units, of which forty are going places

► COMPLETE POWER-GENERATING PLANTS mounted on specially designed railroad cars for use in rebuilding areas devastated by war are being delivered by General Electric Co. They are supplying a total of forty 3000-kw plants and twenty-three 1000-kw plants.

The 3000-kw mobile plant consists of seven or eight cars, depending upon method of cooling. There are two boiler cars and tenders, one turbine car, one switchgear car, three cooling-tower cars (or two radiator-type cooling cars) and one crew car. Thirty of the plants will have cooling-tower cars; ten, radiator-type coolers.

Each of two boiler cars per power plant contains a firetube locomotive-type boiler designed to operate at 300-psi gage and 600 F. Boilers are coal-burning, employing a locomotive stoker designed to burn poor grades of coal, such as lignites, with heat values of less than 7000 Btu per lb. Each boiler is rated 24,000 lb per hr of steam. Induced draft is obtained by a centrifugal fan driven by a geared steam turbine exhausting into a surface-type heater through which the condensate is pumped. The boiler is also equipped with an injector for emergency boiler feed, and automatic, level feed control for normal operation. Adequate supplies of coal and makeup water are carried in a tender car similar to that used for standard locomotives.

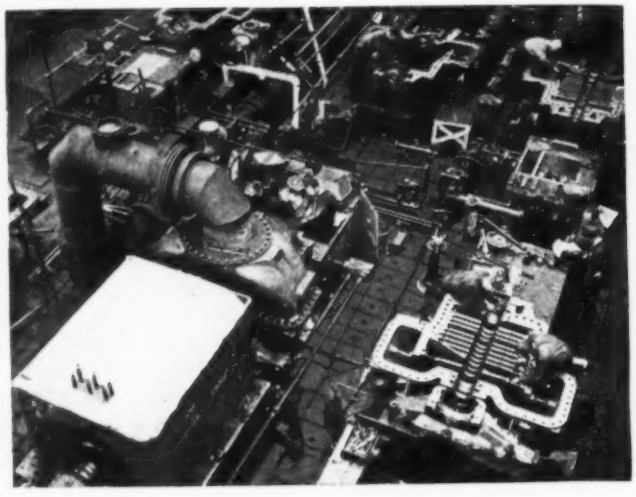
Portable Coal Unloaders

Coal and ashes are handled by portable unloaders and conveyors, which take coal from either pile or coal car and put it into the tender, and which handle ashes from the pit to cars.

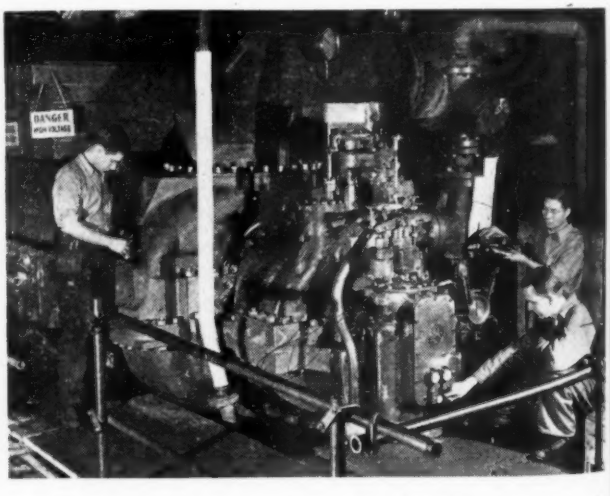
The turbine car contains a 3000-kw 0.8-pf 3750-kva 3-phase turbine-generator arranged to deliver power at either 6300 or 11,000 v. The surface condenser is on the same elevation as the turbine-generator. Condenser and turbine exhaust are connected by an overhead duct. Vacuum is maintained by twin steam ejectors.

The switchgear car contains metal-clad units and also houses indicating and control apparatus for the main generator, together with three oil circuit breakers, one generator circuit and two feeder circuits. The two feeder circuits are brought out through each side of the car near the top for connection to overhead lines. Auxiliary power is supplied by a 300-kva unit substation (500-kva substations are used for the plants with radiator-type cooling). A 12-kw diesel engine-generator set is located in the car to supply energy for operating the boiler filling pump and emergency lighting.

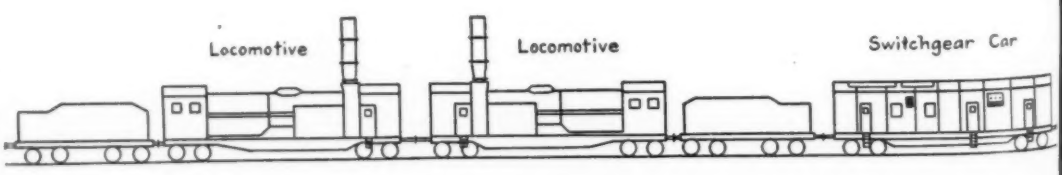
The three cooling-tower cars for each of 30 of the power plants contain wooden cooling surface arranged in two cells, with the wooden structure mounted on a steel water basin on the car platform. Cooling air is supplied by four fans in the top of the car driven



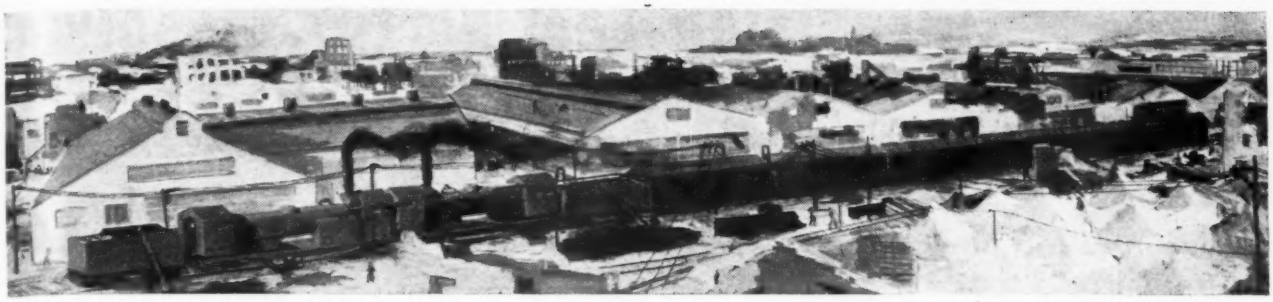
Several of the 300-psi 600-F 3000-kw turbines under construction in G-E shops. Generator can deliver 3750 kva at 6300 or 11,000 v



One of the compact units on test at G-E Schenectady works Turbine-generator and condenser occupy only a single car



A 3000-kw mobile plant consists of 7 or 8 cars, depending on the cooling method



by direct-connected vertical motors. A vertical circulating pump, directly connected to a motor, pumps water through the condenser.

Radiator-type Cars

Two radiator-type cars for each of the other ten power plants contain cooling equipment consisting of tubes and fins assembled in units. Water is circulated through the inside of the tubes and air over the outside of the tubes and fins. Fans and cooling units are so arranged that cooling air can be recirculated to any degree to prevent freezing of the cooling medium. The cooling surface is arranged so that part may be used for bearing oil and related cooling. Air is supplied by eight fans driven by direct-connected motors. A vertical circulating pump directly connected to a motor pumps water through the condenser.

The crew car contains living and sleeping accommodations. A portion of it is a maintenance room and test laboratory.

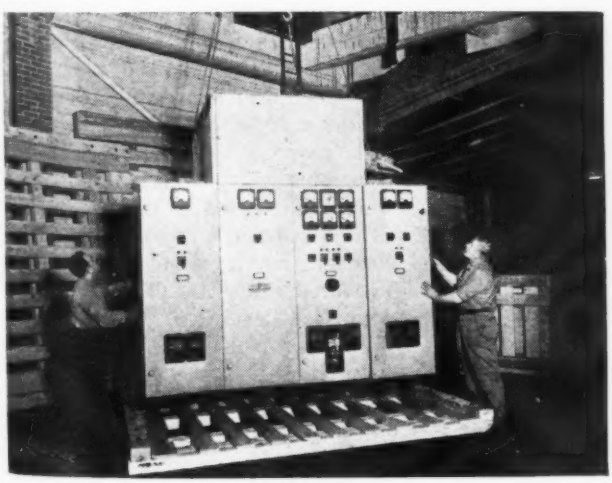
The 1000-kw mobile power plant consists of three cars: one boiler car, one turbine and switchgear car, and one cooling-tower car. The boiler car contains a watertube boiler designed to operate at 420 psi, 725 F. The boiler burns coal fed to the furnace by means of a standard locomotive-type stoker. A hopper built into the car stores coal. As in the 3000-kw plants, the boiler can burn low-grade coals. It is rated to deliver 16,000 lb per hr of steam. A motor-driven induced-draft fan provides furnace draft. Boiler-water storage is carried in a tank on the boiler car. Coal and ashes are handled in the same manner as for the 3000-kw plants.

The turbine car contains a 1000-kw 0.8-pf 1250-kva 3-phase geared turbine-generator, arranged to deliver power at 6300 v. The surface condenser is located at the same level as the turbine. Turbine exhausts upward and over to the condenser through an overhead duct. One stage of feedwater heating is done in a closed heater with steam being extracted from the main turbine to supply the heater.

Switchgear and Auxiliary Power

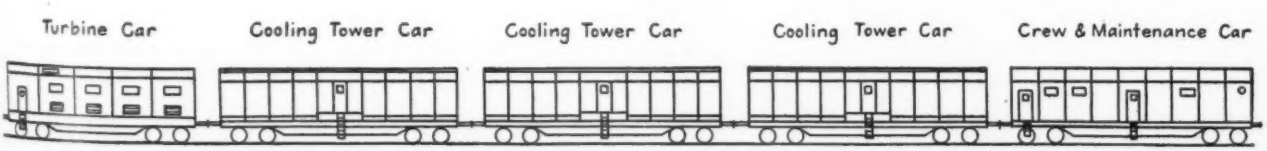
Main metalclad switchgear carried on the turbine car includes indicating and control apparatus for the main generator, as well as two outgoing feeder circuits. Auxiliary power is supplied through a 150-kva step-down transformer connected directly to the main generator leads. A 5-kw gasoline engine-generator on the turbine car provides emergency lighting. The cooling-tower car is a duplicate of that described for the 3000-kw plants.

Each of the mobile power plants is capable of operating through a range of temperatures from —45 F to 110 F. It is expected that a plant can be "put on the line" within 12 hours after it has been brought into an area.



Standardized metal-clad switchgear, 6350 v, for the high-voltage side of mobile power plants being lowered onto shipping skids

Several metal-inclosed switchgear assemblies for the low-voltage side, 400 v, of the portable load center unit substations



Precision Testing for Dissolved

In this second installment J F Sebald, Worthington Pump and Machinery, outlines

► BECAUSE OF ITS GREAT CONVENIENCE as a color indicator to determine the titration end point, starch is widely used for this purpose. While the starch end point may vary from the true result by as much as .03 cc per liter (expressed as dissolved oxygen), the use of starch is justified for oxygen determinations as low as .02 cc per liter, as the average error of a well-run starch titration is about .01 cc. When applied to the usual Winkler test, particularly when there is no positive interference, the starch titration shows dissolved oxygen contents considerably lower than the true value. Even the use of the starch sensitivity-correction curve does not entirely eliminate this tendency to show low results.

When applied to the modified Winkler tests, which correct for interference, the error in starch titration becomes both positive and negative, with the chances of error equal in either direction. This increases the over-all accuracy of the individual test reading. Because the starch end point of titration is not readily discernible, the operator's skill and prejudice greatly affect the accuracy of the test. Data obtained in this manner are extremely difficult, and in many cases impossible, to evaluate.

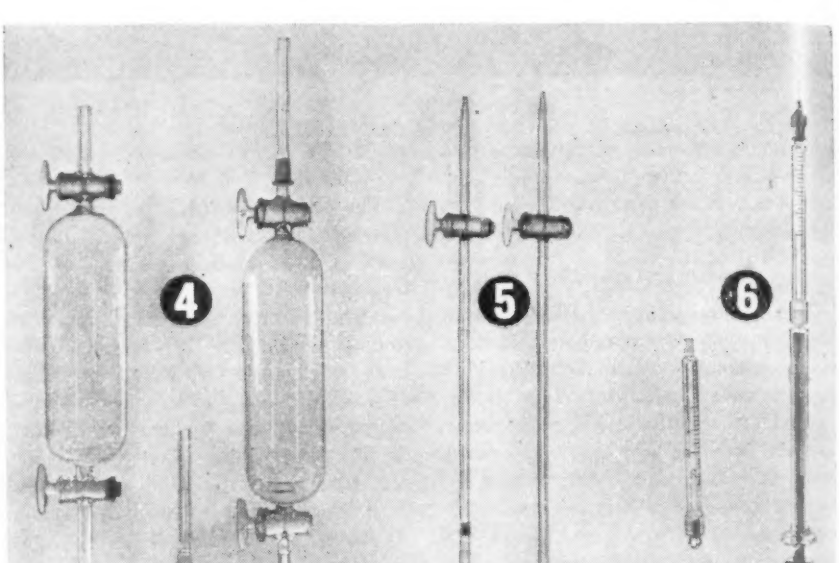


Fig. 4—For collecting samples the McLean flask of proved convenience and reliability permits adding reagents without exposing the sample to the air

Fig. 5—Iodine and sodium thiosulphate solutions are added by these one-cubic-centimeter microburettes which are graduated in 0.01-cc increments

Fig. 6—For final thiosulphate titration, solution is added in 0.01-cc increments by a 0.2-cc pipette which is graduated in 0.01-cc with syringe control

Greater Accuracy Required

Recent improvements in the performance of deaerating equipment require extremely accurate measurements of dissolved oxygen. Deaeration guarantees limiting the maximum oxygen content of boiler feedwater to values not exceeding .005 cc per liter are not uncommon. The test methods devised to correct for interfering compounds, and to eliminate reagent corrections, are necessary for such measurements, but are of doubtful value when using starch as the indicator. Thus it has become necessary to replace the more convenient starch titration with the accurate, although somewhat tedious, potentiometric titration. This applies particularly to waters of very low oxygen content.

Potentiometric titration so reduces the end-point error that miscellaneous errors in test procedure and the performance variations of the deaerating equipment itself show up to an alarming degree. These variations in test results are further complicated by the limitations of the titration instruments. For the most part these were standard apparatus applied to this type of work rather than instruments specifically designed for the purpose. As instrument manufacturers became more familiar with the oxidation reduction titration, their recommendations regarding the type of instrument to use for this purpose greatly improved.

With the error of titration reduced to oxygen values considerably less than .001 cc per liter, it became possible to improve over-all test accuracy by proving the actual test procedure.

While the actual test method and the computation of results is a most important part of any test, it is equally important to determine the reliability of the procedure. No test, however carefully conducted, can be considered mathematically exact. It is probable that the true value of any quantity measured by a series of tests will lie within definite limits, but its actual value remains unknown. To determine these limits, the magnitude of test error must be ascertained.

Variations in test results caused by error may be divided into two general classifications. The first includes the errors caused by limitations of the apparatus, inherent inaccuracy, and defects in instruments and the general test procedure. Many errors from these sources may be avoided, or their magnitude reduced, by careful selection of apparatus and planning of test procedure. The second in this classification of errors includes those of observation, manual technique and fatigue. They are variable, and will persist even under controlled conditions.

Because of the extremely high accuracy required of the test, approaching measurements of one part in a billion, the use of the arithmetical mean for test evaluation cannot be justified. The test results may best be evaluated or interpreted by statistical treatment, that is, by applying the laws of probability. Such an analysis shows that small errors occur more often than large and that positive and negative errors occur with the same frequency.

The first probable error is the magnitude of the deviation from the mean that will include half the test results.

Oxygen in Boiler Feedwater—II

precautions for water sampling and adding of reagents to assure maximum accuracy

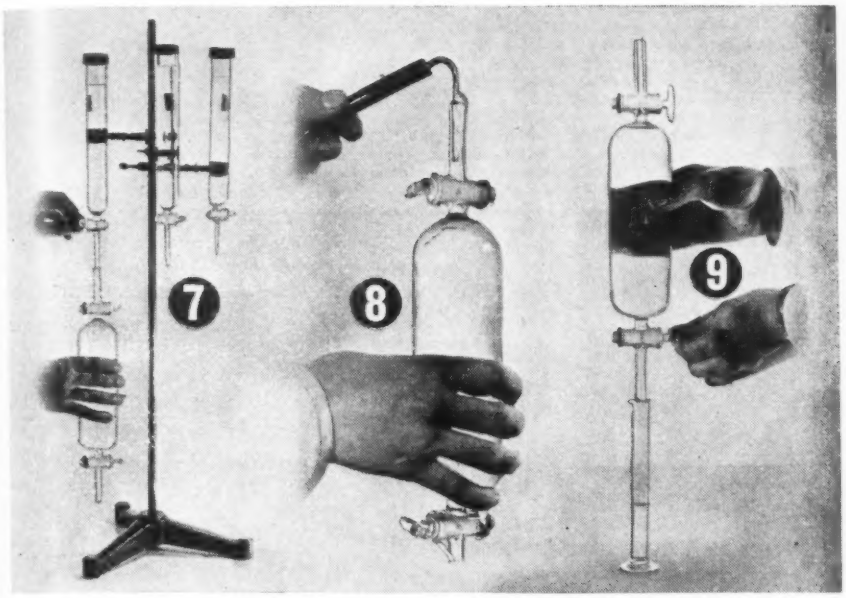


Fig. 7—Storage burettes are a convenient source of reagent supply. Quantity is measured between calibrated marks etched on the McLean flasks

Fig. 8—Rubber-hose bent-tube combination supplied with water from sample cooler provides a convenient means of washing flask ends and tube extensions

Fig. 9—Draining a fixed amount of sample to waste prior to titration avoids contamination by unfixed reagents trapped in the stop-cock bores

Using this first probable error for the test evaluation gives much more dependable information than can be obtained by using ordinary arithmetical means, and exposes the much too common belief that test results can repeatedly approach duplication.

To perfect the test procedure to a point where it would produce reliable and satisfactory results, both the apparatus and procedure involved were analyzed to determine all possible sources of error which could be attributed to this phase of the test. Any improvements in apparatus or procedure that were apparent on the basis of pure deduction or analysis, and that did not involve additional work or time in conducting the test, were incorporated without being proved individually by experiment. Any improvements in the test procedure that involved additional work or time in their performance on the part of the operator were studied individually and adopted only after they were subjected to statistical analysis and proved necessary.

The method selected to improve test procedure was the Schwartz Gurney "A" modification of the Winkler test. This particular method was selected because it requires less work to conduct than any of the various Winkler test modifications that incorporate interference correction.

Basic Test Procedure

For collection of samples, the McLean flask, Fig. 4, offers proved convenience and reliability. Its construction permits collecting samples and introducing reagents without exposing the sample to air.

For adding iodine compound—standardized $KH(IO_3)_2$ solution—to the fixed samples prior to titration and for conducting the major part of sodium thiosulphate titration, one-cc microburette graduated in 0.01-cc increments, Fig. 5, is much less tiresome to the operator and requires less practice for accurate results than the conventional measuring pipette of the same calibration.

For the final part of the thiosulphate titration in which solution is added in 0.01-cc increments, a 0.2-cc pipette, graduated in 0.01-cc divisions, attached to a syringe, Fig. 6, can be used without fatigue and with extreme accuracy even by inexperienced operators.

For the potentiometric titration, an electronic voltmeter with about 3½-in. scale deflection for an emf change of 130 millivolts reads directly and requires no balancing between individual voltage readings. Neither the conventional potentiometer with Wheatstone bridge circuit nor the usual type of pH meter offers quite the same convenience or adaptability to the titration as the electronic voltmeter.

Introducing Reagents

For introducing reagents to the McLean flasks, storage burettes, Fig. 7, afford a most convenient means. No calibration is necessary as the reagent quantity is measured between marks on the flask ends or separate reagent cups. Loose fitting covers on the burettes prevent dust contamination of the reagents.

For washing reagents from the flask ends or tube extensions, a bent piece of thin copper tubing attached to rubber tubing from the sample cooler, Fig. 8, introduces deaerated water to the flask extension tube for thorough cleansing.

A counter-current sample-cooling coil should have capacity to handle not less than ½ gpm to a temperature at least 10 F below that of the room. Subcooling is necessary to prevent a partial vacuum forming inside the McLean flask during fixing of the sample. Contamination by seepage of air into the flask has been observed under these conditions. If, however, the sample is cooler than the surrounding air, it expands from standing and from the heat of reaction of the reagents maintaining a positive pressure in the flask at all times.

The following procedure for collecting samples is most satisfactory:

1. Control flow of deaerated water to sample bottle by throttling between cooler outlet and McLean flask. This keeps most of sampling line and cooler under positive pressure and reduces chance of sample contamination by leakage.

2. Allow sampling line and cooler to run at least a half hour before taking samples. Time is needed to purge the system of air, dirt and scale.

3. Clean McLean flasks and lubricate

stopcocks adequately. Air bubbles tend to cling to dirty surfaces and are difficult to dislodge. Inadequately lubricated stopcocks are difficult to manipulate and invite air leakage. Chromic acid solution is an effective cleanser for laboratory glassware.

4. Mount sampling flasks vertically with the opening of the upper stopcock the highest point inside the flask. This avoids trapping air in the flask.

5. If discharge hoses carry off water from the flask, they should terminate above the flask. Otherwise they produce a siphon effect subjecting the flask to partial vacuum and inviting contamination of the sample from air leakage.

Table III—Comparison of Probable Errors of Tests In Relation to Specific Test Procedures

Test No.	Type of test	Test group	Test procedure*	First probable error cc per liter
1	Schwartz Gurney "A"	A	1	±0.0059
2	Schwartz Gurney "A"	B	2	±0.0019
3	Schwartz Gurney "A"	B	3	±0.00095
4	Schwartz Gurney "A"	A	3	±0.00078
5	Schwartz Gurney "A"	B	3	±0.00062
6	Schwartz Gurney "A"	C	3	±0.00097
7	Navy Modification of Schwartz Gurney "A"	C	3	±0.00093

*Basic test procedure:
1. Without washing flask ends and draining unfixed reagents trapped in stopcock bore.
2. Plus washing flask ends but without draining unfixed reagents trapped in stopcock bore.
3. Plus washing flask ends and draining unfixed reagents trapped in stopcock bore.

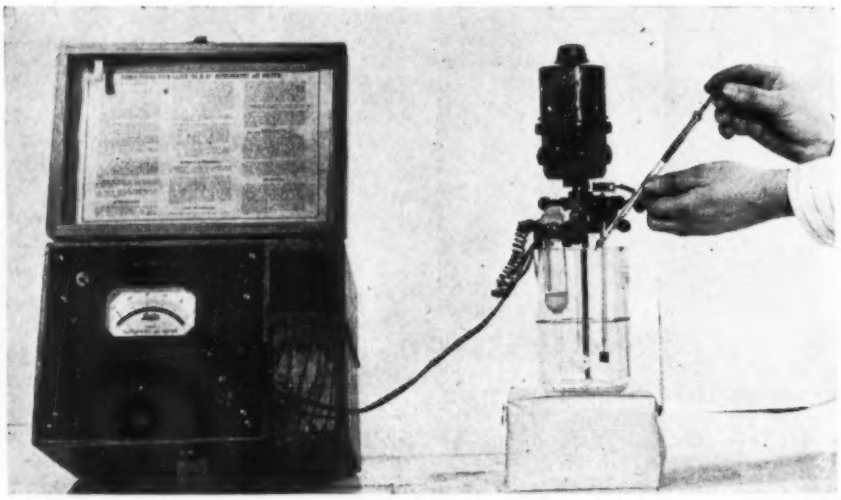


Fig. 10—Arrangement of equipment for thiosulphate titration by potentiometric method as used in all tests of both Winkler and interference samples

6. Adjust flow rate to fill each flask in about 45 to 60 sec. More rapid flow induces turbulence and may result in eductor action at the stopcocks.

7. When sample bottles are filled oscillate them sharply about their long axes to dislodge air bubbles clinging to inside surfaces. Rotate both stopcocks to dislodge air bubbles clinging to greased surfaces.

8. Allow flow to waste long enough to produce at least 10 volume changes after all visible air bubbles have been expelled.

9. Shut off water supply to sampling flasks by closing throttle valve quickly. Stopcocks should be closed immediately afterwards. If deaerated water is under relatively low pressure, it is sometimes possible to close stopcocks first to keep flasks under pressure. This is desirable where pressure permits.

10. Examine samples for visible air bubbles. If none are present, sample is ready for addition of reagents.

Proper procedure for adding reagents includes:

1. Treat the Winkler sample first so that it remains in an unfixed state as short a time as possible. Take all possible precaution as this sample is easily contaminated by air. The interference sample is not affected by air and can be handled without fear of contamination from this source.

2. Shake water out of flask ends by a brisk oscillating motion being sure to keep the long axis of stopcocks at right angles to the plane of motion. Otherwise, stopcock plugs may be dislodged and the flask as well as the sample become worthless.

3. From the storage burettes add the No. 1 Winkler reagent to the tube extension of the McLean flask so that the level coincides with the upper etched mark. The measured volume between the two marks is the amount of reagent to be introduced into the sample. The lower etch mark should be located so that an appreciable depth of reagent seals the stopcock from air when the full reagent quantity has been added to the sample.

4. Open the top stopcock first and allow reagent to flow into the flask by throttling the lower stopcock. When the correct amount of chemical has been added, close the lower stopcock, then the upper one. Controlling flow of reagent by the lower stopcock keeps the flask under positive pressure during the addition of chemicals.

5. Shake excess liquid from flask ends as described in (2).

6. Add No. 2 reagent as described in (3) but from the opposite end of the flask to avoid any contact between the two reagents in air. Mixing these chemicals liberates iodine which, if introduced into the sample, causes serious error.

7. Shake excess liquid from flask ends as described in (2).

8. Add No. 3 reagent in the same manner and from the same end of the flask as No. 1.

9. Shake excess liquid from flask ends as described in (2).

10. If no air bubbles are visible, sample is ready for titration.

11. Fix interference sample exactly the same as the Winkler sample except that No. 2 reagent is added first, followed by No. 3 from the opposite end of the flask. Then add No. 1 from the same end as No. 3. After shaking excess liquid from flask ends, sample is ready for titration.

Procedure for potentiometric titration:

1. It is advisable although not absolutely necessary to titrate the Winkler sample first.

2. Wash titrating beaker, electrodes and stirrer with distilled water to avoid contaminating sample with residue of previous titrations.

(*Continued on page* 200)

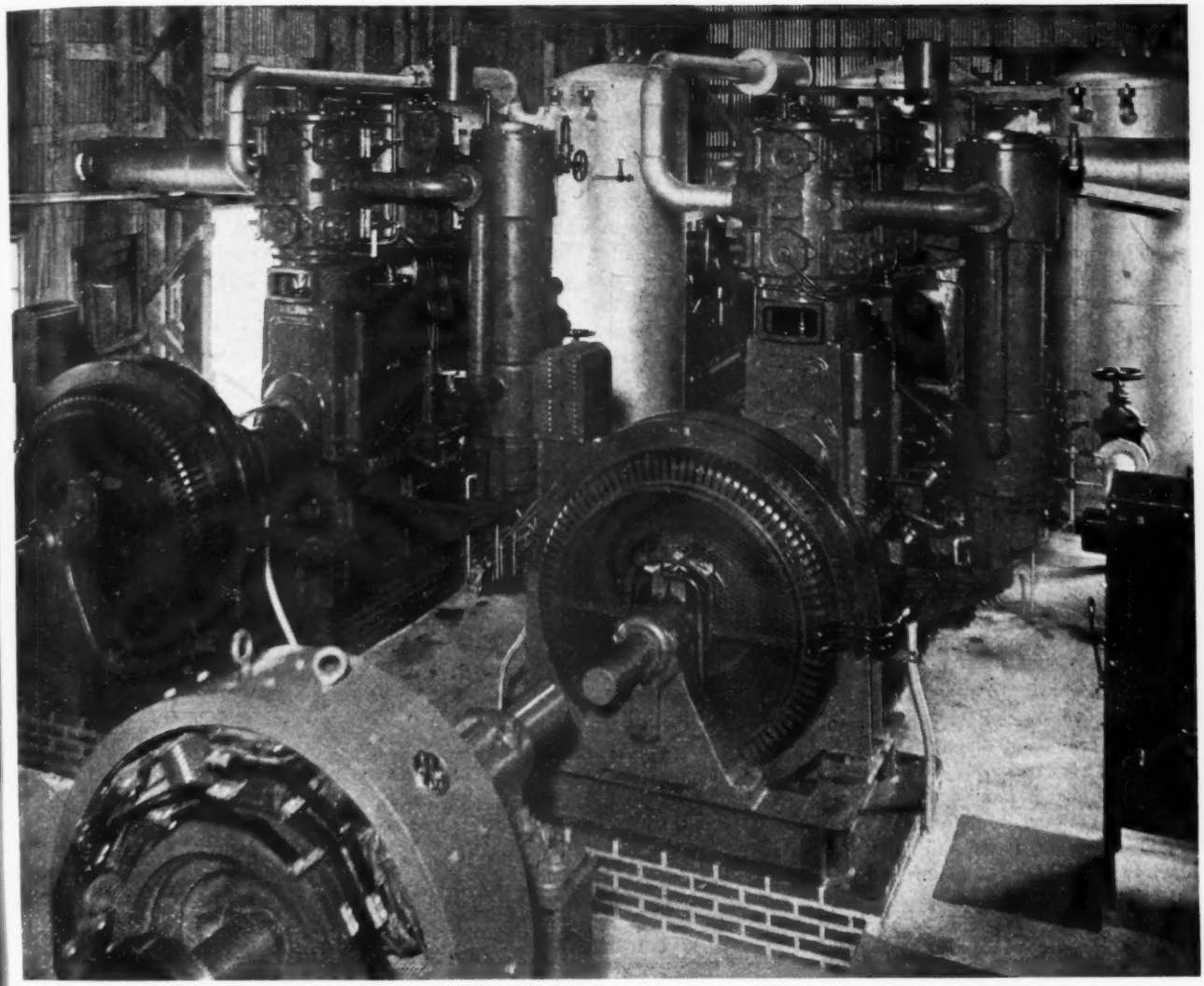


Fig. 1—Complete cooling between stages of these synchronous motor-driven 2-stage vertical air compressors helps them produce more air per kwhr of energy used. Adequate receiver capacity stores air and reduces pulsations in the delivery line

Don't Overlook These Gas Laws

If you expect compressors to perform efficiently comply with the gas laws. H H Miller, Worthington Pump & Machinery Corp, discusses their effect on machines with various gases

▶ COMPRESSORS, either reciprocating or rotating, act on air or gas to increase pressure from a lower to a higher value. The gas to be compressed (consider air as just another gas) may be at any initial pressure, or the pressure to which it is compressed may vary likewise over extremely wide limits. Compression may take place below atmospheric pressure, as in a vacuum pump, or at quite high pressures (over 5000 psi) as in various catalytic processes, such as manufacture of synthetic ammonia, liquefication of gas or for high-pressure testing.

Pneumatic tools for modern machine shops, mines and quarries are designed to operate on standardized air pressures of 80 to 125 psi, for which a standard compressor is built and available. However, when used in chemical or oil-refining processes, the required pressures cover an extremely wide range, so much so that there are hardly any two services in these fields that use duplicate compressing equipment. It is this wide application that makes impossible the standardizing of compressors, either in size or type, for other than pneumatic tool supply. Likewise, the services, as well as the character of the gas being handled, make it impossible to standardize materials for other than standard air compressors. However, regardless of how they are constructed compression takes place according to well-known gas laws.

Boyle's Law teaches that, if temperature remains constant, the volume occupied by a given weight of gas varies inversely as the absolute pressure. By the same law, to increase the pressure we must reduce the volume in the ratio

of absolute pressures provided temperature remains constant. Were it possible to increase the pressure of a perfect gas without increasing its temperature, we would have *isothermal* compression (a condition in which temperature remains constant throughout the compression stroke). This would necessitate removing all compression heat generated in the compressor, which, of course, is impossible. Therefore isothermal compression is only wishful thinking and cannot be approached in practice.

Charles' Law teaches that, with its pressure remaining constant, the volume of gas increases with increase in temperature and this increase in volume is in the ratio of its absolute temperatures.

Therefore, when a gas is compressed and its pressure as well as temperature increases, its final volume will be considerably greater than that expected by Boyle's Law of a perfect gas by which, with constant temperature, volume varies inversely as the pressure.

The general law of gas compression is expressed by PV^n=a constant. In isothermal compression, value of n is one, and therefore PV=a constant, as in Boyle's Law. However, little of the compression heat is removed within the compressor cylinder, and therefore isothermal compression is entirely theoretical. When all heat of compression is retained by the gas as its pressure increases, compression is *adiabatic*, and the value of n then becomes the ratio of the specific heat of the gas at constant pressure to its specific heat at constant volume.

Derivation of n Value

Air's specific heat at constant pressure varies slightly with temperature. At normal atmospheric temperatures its specific heat at constant pressure is usually considered 0.2375 Btu lb. Its specific heat at constant volume is 0.1689 Btu lb. Therefore, the value of n for dry air becomes

$$\frac{0.2375}{0.1689}$$ or 1.406, and the equation for adiabatic compression is therefore $P_1V_1^{1.406} = P_2V_2^{1.406}$ =a constant. Naturally, the specific heats of different gases vary considerably, the majority having a somewhat lower n value than air. Among the more common are the hydrocarbon series that have an especially low n value. (See table of n values of different gases.)

Since the value of n not only influences the horsepower required for compression but also the re-expansion of clearance air in the cylinder and, therefore, the volumetric efficiency also, this factor of the specific gas to be compressed must be known. If it is mixed gas, such as is frequently encountered in oil refinery work, an accurate analysis must be made so that the n value of the mixture may be fairly accurately determined. Obviously, the greater the n value, the steeper the compression curve and the clearance re-expansion line. Conversely, lower n values result in a less steep compression line and therefore less input horsepower, and in a longer re-expansion line that results in lower volumetric efficiency.

Relation between isothermal and adiabatic compression is well illustrated by the combined cards of a 2-stage compressor, Fig. 2. In addition to the theoretical and actual compression lines, the diagram shows the saving when using 2-stage compression and intercooling, as well as the inevitable losses through compressor valves, imperfect cooling in the intercooler, and volumetric loss from re-expansion of clearance air in the low-pressure cylinder. Actual compression line lies between the adiabatic and isothermal theoretical curves.

Loss through valves is indicated by the difference between pressure within the cylinder and the mean gage pressure. Obviously, the valve will not open

Values of *n* and Properties of Various Gases

All figures given are on the basis of 60 F and 14.7 psi abs

Name of gas	Symbol	Cp/Cv = n	Spec grav Air = 1.00	Molecular wt	Lb cu ft	Cu ft lb	Boiling point at atmos press F	Critical temp F	Critical pressure psi ab
Acetylene	C_2H_2	1.3	.9073	26.0156	.06880	14.534	−118	96	910
Air		1.406	1.000	28.9752	.07658	13.059	−317	221	546
Ammonia	NH_3	1.317	.5963	17.0314	.04509	22.178	− 28	270	1638
Argon	A	1.667	1.379	39.944	.10565	0.467	−302	−187	705
Benzene	C_6H_6	1.08	2.6953	78.0468	.20640	4.845	176	551	700
Butane	C_4H_{10}	1.11	2.067	58.078	.15350	6.514	31	307	528
Butylene	C_4H_8		1.9353	56.0624	.14826	6.7452			
Carbon dioxide	CO_2	1.30	1.529	44.000	.11637	8.593	−109	88	1072
Carbon disulphide	CS_2	1.20	2.6298	76.120	.20139	4.965	115	523	1116
Carbon monoxide	CO	1.403	.9572	23.000	.07407	13.503	−313	−218	514
Carbon tetrachloride	$C\,Cl_4$	1.18	5.332	153.828	.40650	2.4601	170	541	661
Carbureted water gas		1.35	.4090						
Chlorine	Cl_2	1.33	2.486	70.914	.18750	5.333	− 30	291	1118
Dichloromethane...	CH_2Cl_2	1.18	3.005	84.9296	.22450	4.458	105	421	1490
Ethane	C_2H_6	1.22	1.049	30.0468	.07940	12.594	−127	90	717
Ethyl chloride	C_2H_5Cl	1.13	2.365	64.4960	.17058	5.866	54	370	764
Ethylene	C_2H_4	1.22	.9748	28.0312	.07410	13.495	−155	50	747
Flue gas		1.40							
Freon (F-12)	$C\,Cl_2F_2$	1.13	4.520	120.9140	.31960	3.129	− 21	233	580
Helium	He	1.66	.1381	4.002	.01058	94.510	−452	−450	33
Hexane	C_6H_{14}	1.08	2.7395	86.1092	.22760	4.393	156	454	433
Hexylene	C_6H_{12}		2.9201	84.0936	.22250	4.4951			
Hydrogen	H_2	1.41	.06952	2.0156	.00530	188.62	−423	−400	188
Hydrogen chloride	H Cl	1.48	1.268	36.4648	.09650	10.371	−121	124	1198
Hydrogen sulphide	H_2S	1.30	1.190	34.0756	.09012	11.096	− 75	212	1306
Iso-butane	C_4H_{10}	1.11	2.0176	58.078	.15365	6.5135	14	273	543
Iso-pentane	C_5H_{12}		2.5035	72.0936	.19063	5.2451			
Methane	$C\,H_4$	1.316	.5544	16.0312	.04234	23.626	−258	−116	672
Methyl chloride	$C\,H_3Cl$	1.20	1.785	50.4804	.13365	7.491	− 11	289	966
Naphthalene	$C_{10}H_8$		4.423	128.0624	.33870	2.952			
Natural gas* (app avg)		1.269	.6655	19.463	.05140	19.451			
Neon	Ne	1.642	.6961	20.183	.05332	18.748	−410	−380	389
Nitric oxide	NO	1.40	1.037	30.008	.07935	12.605	−240	−137	954
Nitrogen	N_2	1.41	.9672	28.016	.07429	13.460	−320	−232	492
Nitrous oxide	N_2O	1.311	1.530	44.016	.11632	8.595	−129	98	1053
Oxygen	O_2	1.398	1.105	32.000	.08463	11.816	−297	−182	730
Pentane	C_5H_{12}	1.06	2.471	72.0936	.19055	5.248	97	387	485
Phenol	C_6H_5OH		3.2655	94.0468	.24870	4.022			
Propane	C_3H_8	1.15	1.562	44.0624	.11645	8.587	− 48	204	632
Propylene	C_3H_6		1.4505	42.0468	.11115	8.997	− 52	198	661
Refinery gas* (app avg)		1.20							
Sulphur dioxide	SO_2	1.256	2.264	64.060	.16945	5.901	14	315	1141
Water vapor (steam)	H_2O	1.33**	.6217	18.0156	.04761	21.004	212	706	3226

* To obtain exact characteristics of natural gas and refinery gas, the exact constituents must be known
** This n value is given at 212 F. All others are at 60 F.

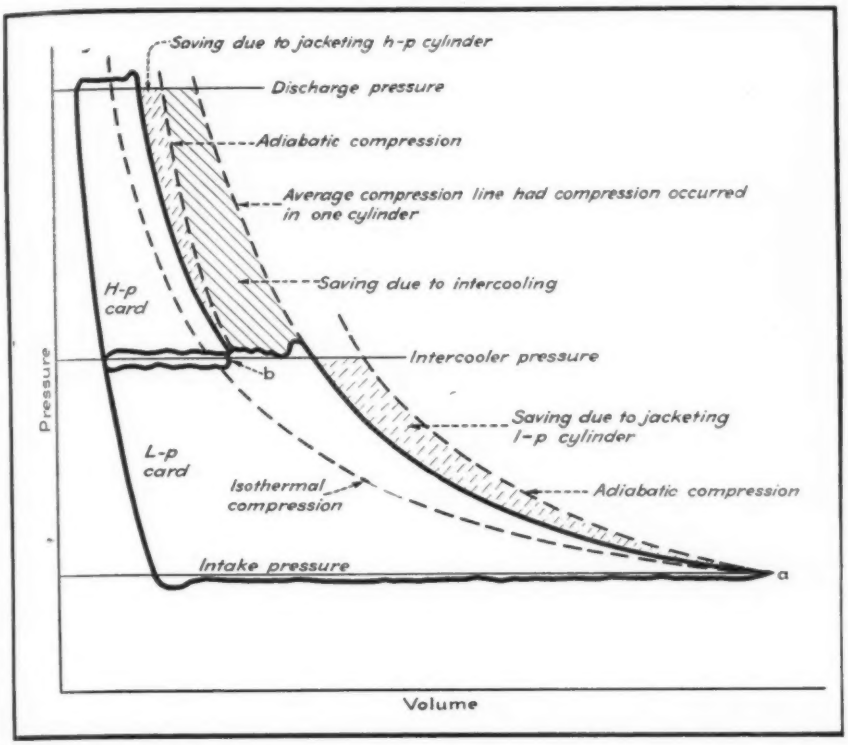


Fig. 2—Combined indicator cards from a 2-stage compressor show how cylinder water jackets and intercooler help bring compression line nearer to isothermal

which must be added the machine's mechanical friction to obtain brake horsepower) they do not truly represent the volumetric efficiency and actual free-air capacity of the compressor. Volumetric efficiency depends upon many conditions not exposed by the indicator card; it reflects the effect of cylinder clearance only in re-expansion of clearance air to intake pressure at the end of the stroke. Other factors that affect volumetric efficiency and actual free-gas capacity are:

1. Heating of gas as it passes into cylinder.
2. Valve leakage, especially of inlet valve.
3. Piston-ring leakage, which allows gas to pass by the piston and enter the cylinder end having its inlet valves open.
4. Valve slip at the end of compression stroke, which allows a certain volume of compressed gas to slip back before the valves close.

These factors and their effect on compressor capacity will be discussed in a later article that also explains intercooler temperature and pressure.

until there is a pressure differential across it, and friction through the valve depends to a considerable extent upon the mean gas velocity—a function of the valve's area.

Imperfect cooling in the intercooler is indicated by the high-pressure intake volume, *b*, Fig. 2, not having shrunk to the isothermal-compression line which indicates the low-pressure intake temperature. This condition depends, of course, on the temperature of intercooler circulating water, as well as on intercooler size and design. It is usually possible, with well-designed intercoolers, to cool the low-pressure-discharge gas back to the temperature of the low-pressure intake and thus obtain perfect cooling when the circulating water is 20 F colder than the intake air. An insufficiently large and poorly designed intercooler would produce imperfect cooling even though cooling-water temperature were favorable.

Volumetric Efficiency

Indicated volumetric efficiency is the ratio of the effective intake length of the indicator card (measured from points at each end where intake line crosses the atmospheric or base line) to the total length of the card.

While accurately taken indicator cards are a true measure of the horsepower absorbed in compressing air (to

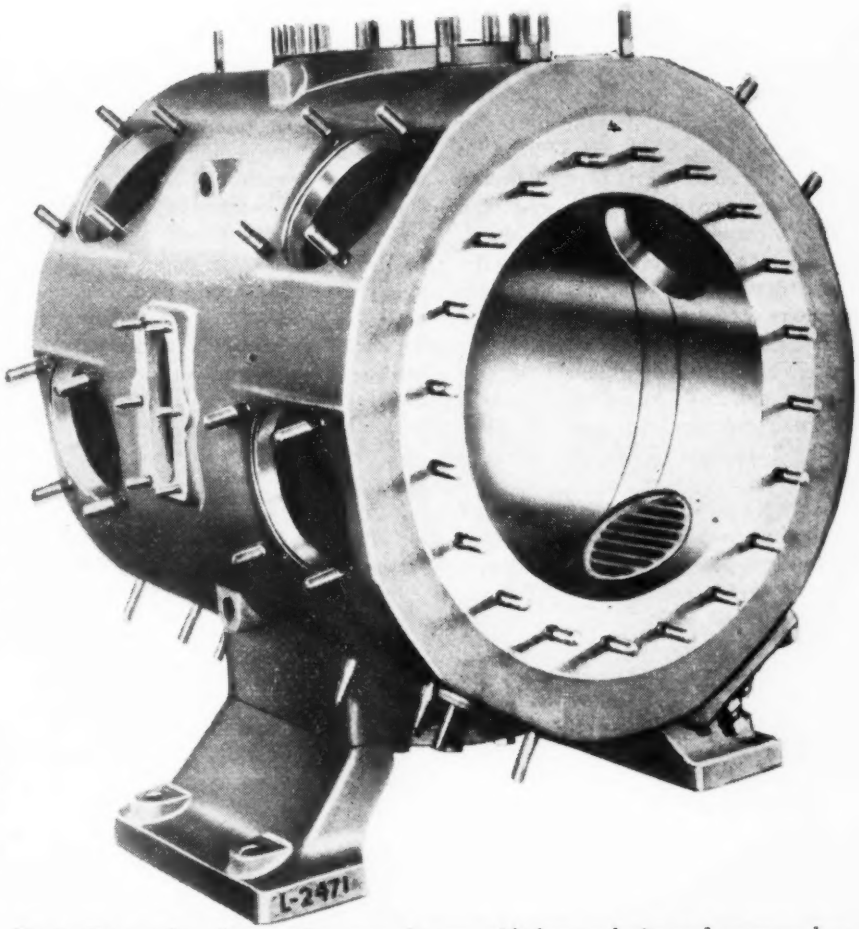


Fig 3—Keep valves free so they pass the gas with least velocity and pressure loss. This reduces pressure differential on both intake and discharge strokes

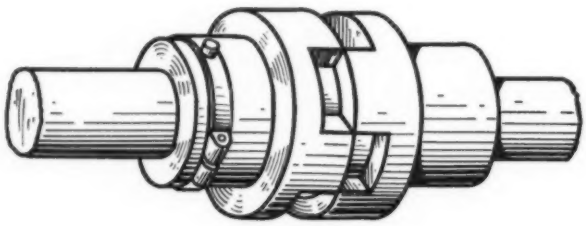


FIG. 1

FIG. 2

Fig. 1 and 2—Jaw clutches are the simplest and the lowest in cost, but are suited to slow speed only and must be engaged and released when the shafts are at rest. Fig. 3—Cutoff-coupling friction-disk clutch arranged as a coupling between the ends of a driving and a driven shaft. Fig. 4—Pulley design of friction-disk clutch used to take power off a lineshaft to drive a machine or a group of machines, the latter from a countershaft

CLUTCHES: Jack-of-All-Trades in Mechanical Power Transmissions

► APPLYING ELECTRIC POWER to one machine or a group includes selection of a suitable motor, a motor starter or speed controller, and means of connecting the motor to its load. The latter may require shafting, bearings and hangers, couplings, flat belts, multiple V-belts, chain drives, gears, variable-speed transmissions, clutches, and combinations of two or more of these mechanisms. For many drives, either group or individual, clutches offer a wide range of improved machine operation and simplified power applications. They are built in different types, such as:

1. *Simple-revolution clutch.* When applied in machine operation it makes one revolution and is then automatically released. It is used on shears, punches and slow-speed shafts.

2. *Overrunning clutch.* It engages as long as the load tends to run at a lower speed than the power source, but releases if the drive slows down faster than the load. It is used on dual-drive units in power plants and other places, and with multi-speed motors driving loads that have high inertia.

3. *Centrifugal or automatic clutch.* When starting, the clutch remains released below a predetermined speed. As the power unit accelerates above this speed the clutch automatically engages, starts the load and brings it up to speed. It connects motors automatically to high-inertia loads and thus simplifies starting. Frequently the application of such clutches permits using a smaller and simpler motor and starter than would otherwise be required. These clutches also connect gasoline engines to their loads so that an engine may be started and brought to near operating speed before applying load. There are other applications, such as on gasoline engines driving refrigeration compressors. Here after the temperature reaches a predetermined low value the control slows the engine down to where the automatic clutch releases, the compressor stops and the engine idles at reduced speed and no load. When the temperature rises to the set value the control accelerates the engine to full speed and the clutch automatically connects it to the compressor to restore the temperature to the proper value.

4. *Magnetically operated clutch.* Generally known as a magnetic clutch, it is similar to a friction-disk clutch but is applied and released by energizing and deenergizing an electromagnet built into the clutch body. Friction surfaces are held together under pressure by magnetic instead of mechanical force as in the conventional friction clutch.

5. *More recent development in a magnetic clutch.* Commonly known as a magnetic coupling or variable-speed drive, it transmits torque as an electric motor does. It is frequently used as a variable-speed drive or to permit the prime mover to accelerate to full speed before starting the load. In addition, it serves as a coupling between power source and load. Usually it is larger and heavier than a mechanical clutch of similar capacity but is smooth in operation. Strictly speaking, it is not a clutch because there is normally 3 to 5% slip between its driving and driven parts unless means are provided to lock the two together after acceleration.

6. *Hydraulic coupling.* Sometimes used as a clutch, it is a variable-speed device like the magnetic variable-speed described in 5. It is partly filled with oil which the driving element pumps into the driven element to drive it as a turbine. This coupling, in addition to serving as variable-speed drive, also accelerates the load, the same as a friction clutch, after the prime mover has come up to speed. Occasionally, it has been used in combination with a mechanical clutch. The hydraulic

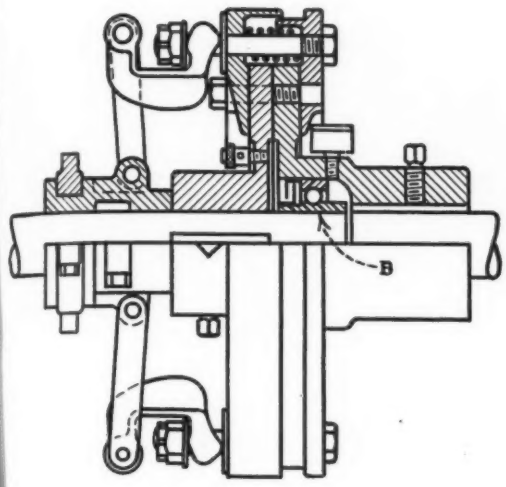


FIG. 3

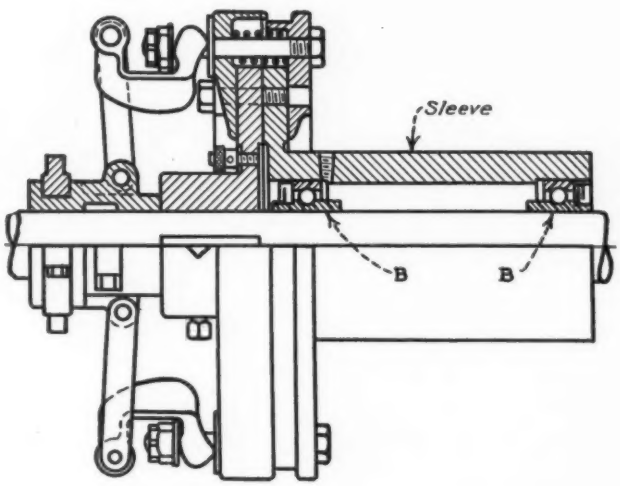


FIG. 4

John T Barron, manager, transmission department, Kinney Manufacturing Co, outlines general design of different types of friction, magnetic and hydraulic clutches and presents eight conditions that must be met in their selection and application to insure satisfactory operation

coupling accelerates to within 3 or 4% of driver speed, after which the mechanical clutch is closed to lock driving and driven elements together.

7. *Jaw clutch.* A form of coupling that can be manually engaged and disengaged. Two general designs are square jaw, Fig. 1, and spiral jaw, Fig. 2. The simplest in design and lowest in cost, they are suitable for slow-speed applications where they can be engaged and disengaged when their shafts are at rest. If disengaged while in motion, the load must be light to prevent overstressing the jaws when they approach the disengaged position. If reversed torques are likely to occur, use the square jaw because the spiral jaw will open on reverse torque.

8. *Manually operated friction clutch.* In many forms, such as single disk, multiple disk, single- and double-faced disk, radically operated, axially operated, compression expanding, in-

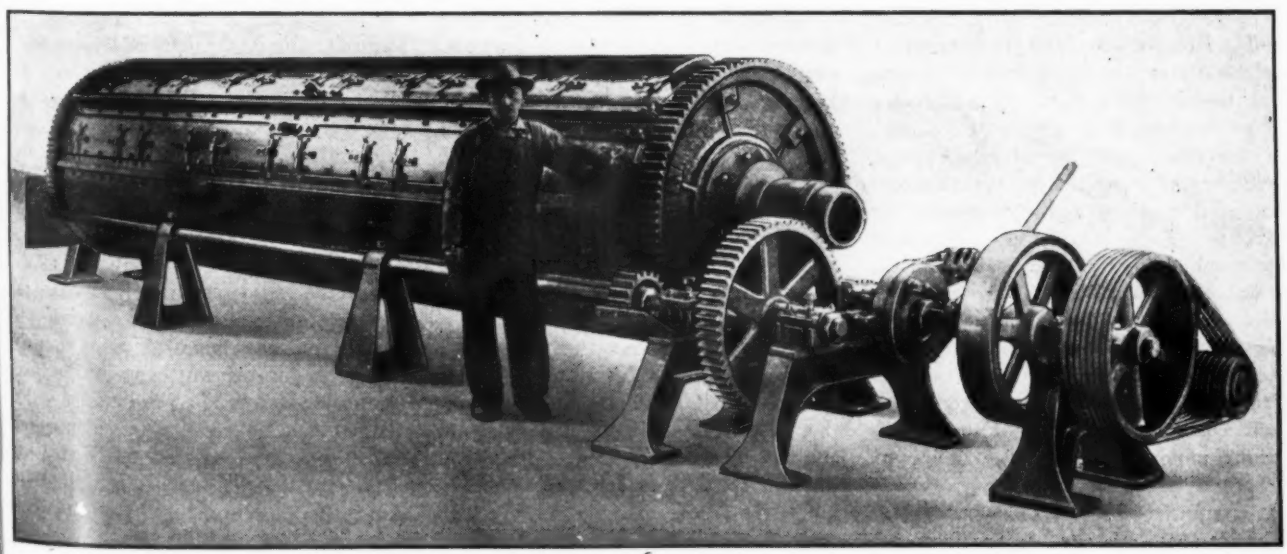


Fig. 5—This heavy tumbling mill when loaded requires only 12 hp to drive it after it is accelerated, but needs a motor several times this capacity to start it directly. Installing a friction clutch for starting the mill permitted the motor to be selected on the basis of horse-power requirement to drive the mill rather than on that needed to accelerate it

ternally or externally expanding, cone, coil and others. All, however, transmit torque by friction between two or more surfaces, held in contact under pressure. Other designs of friction clutch are marketed under different names derived from the means of engaging and disengaging them, such as those actuated by compressed air or pressure liquids. Flat-faced friction clutches of many designs are widely used. Difference in design is usually in the method of applying pressure to the friction surfaces to engage the clutch.

Friction clutches are built to apply as cutoff couplings or as line-shaft clutches. In the former applications, they serve to connect a power source to its load or as a disconnect coupling between the two halves of a lineshaft, Fig. 3. In this design the shaft end of the left-hand half of the coupling is supported on a ball bearing, *B*, in the right-hand half, to maintain good alignment between the two.

For lineshaft-clutch applications, Fig. 4, the clutch is located on a lineshaft where power is taken off to drive a machine or a countershaft driving a group of machines and for similar applications. One half of the clutch has a long sleeve that extends along the shaft. In Fig. 4 the sleeve supported on two ball bearings, *B*, permits the shaft to turn freely in this half of the clutch when it is disengaged. A pulley, sheave, chain sprocket or gear mounted on the sleeve drives the load while the other half of the clutch, keyed to the shaft, engages the pulley half.

Power Takeoffs

Clutches, built in as part of a gasoline engine to permit it to start before applying load, are known as power takeoffs. However, a clutch to connect an electric motor to the end of a lineshaft or to the drive shaft of a machine becomes a cutoff coupling.

Among their many applications, clutches in group drives either connect or disconnect single machines or groups. These machines can be driven by a motor of less horsepower than the total required if each machine were connected to its own motor. Operating costs are generally less, because the large motor operating more closely to its rated load has a better power factor and efficiency than a lot of small individual-motor drives.

Often where frequent load reversals are required—several times a minute, for instance—clutches do the job most economically. They permit the power unit to operate continuously at full speed in one direction, while they do the reversing. This service is severe and clutches should be selected accordingly.

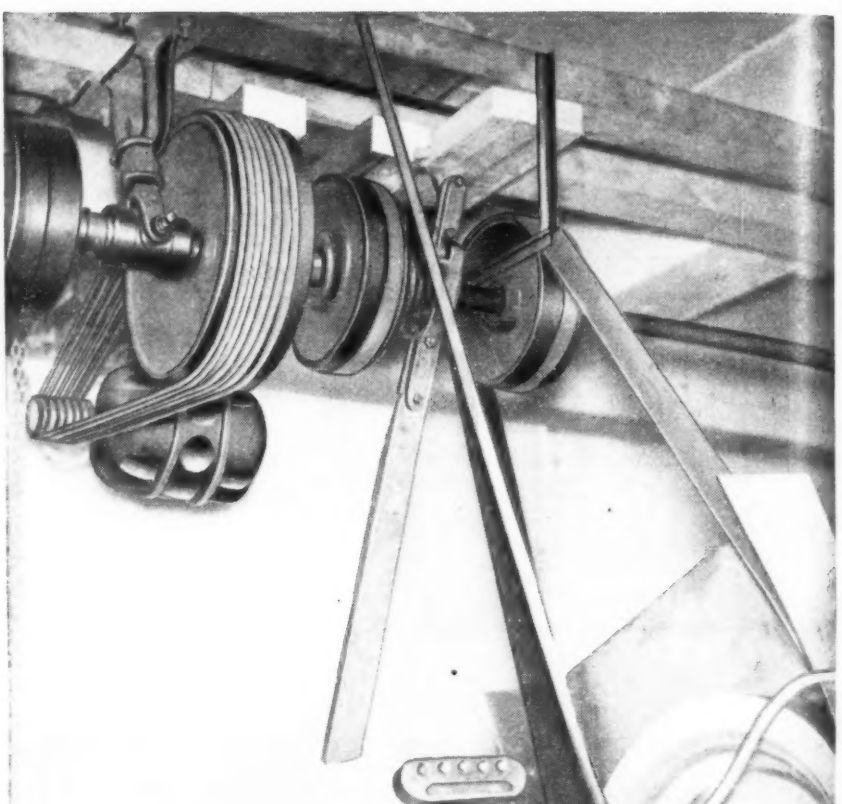


Fig. 6—Here four presses, driven from a lineshaft requiring 12 hp to start, are easily handled by a 5-hp motor when starting is done by a friction-pulley clutch

When power for starting a load is much greater than the running load, a clutch may permit a considerably smaller and lower-cost motor than if the motor were continuously connected to the load. Fig. 6 shows an application of this kind where a motor drives four presses from a lineshaft through a clutch. The press manufacturer specified 12 hp to start and drive these presses. With the help of a clutch, a 5-hp motor does the job satisfactorily.

Fig. 5 shows another difficult starting job made easy with a clutch. This heavy tumbling mill requires only 12 hp to drive it after being accelerated.

However, it needs a direct-coupled motor of several times this capacity to start and accelerate the mill in a reasonable time. Installing a clutch made it possible to start and accelerate the mill with a simple high-efficiency squirrel-cage motor, selected for power to drive the mill after acceleration.

Clutches may also be an overload safety device between the load and its driving motor. When the load increases above a safe value the clutch slips to protect the driven equipment. In one case, a screw conveyor carried clay from a bin to a pug mill. When the mill did not handle the clay as fast as delivered by the conveyor the latter plugged up and broke the shear pin in the drive. Time was lost before the conveyor stoppage was discovered and the shear pin replaced. Replacing it with a slip clutch between the power drive and the conveyor corrected the trouble. Now when the conveyor clogs, the clutch slips until the pug mill relieves the conveyor. In this application the clutch serves as a safety device and, in addition, can be engaged and disengaged to start and stop the load as required by the operation.

Winding-Machine Application

Another slip-clutch application is on winding machines where fabric is wound off one mandrel onto another operating at constant speed, the two connected by a slip clutch. As the diameter of roll on the driven mandrel increases, speed of the web increases. To keep equal tension in the web at all times the clutch on the driven mandrel slips so the material winds without wrinkles.

These applications indicate some of

(*Continued on page* 146)

An Adjusted Brine Checks Corrosion

The pH of calcium or sodium-chloride brine plays a leading role in inhibiting corrosion of ice cans and piping. To show quickly how much corrective material is needed to restore optimum pH, here are two ingenious devices in the form of a chart and a disk*

By GEORGE A PAPE
Borden's Farm Products Laboratory

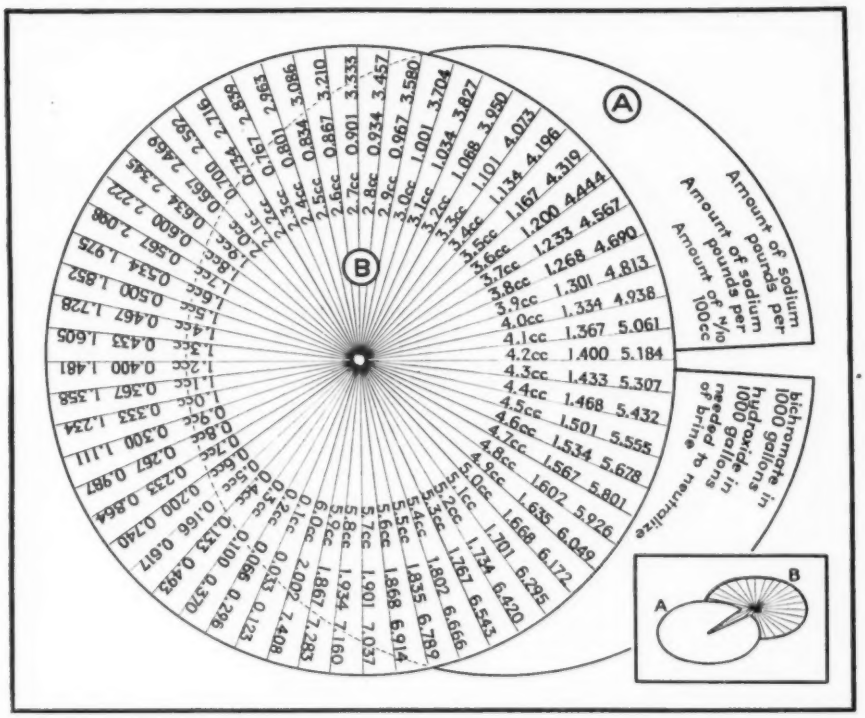
▶ SODIUM CHROMATE retards corrosion by building up a protective film on metal parts when proper concentration is maintained, together with correct brine pH. Sodium *bichromate*, however, is generally used because it costs less, is easier to obtain, has a slightly retarding effect, and is easily converted to chromate by adding an alkali, such as caustic soda.

Treating brine with a chromate inhibitor effectively reduces corrosion of iron and zinc-galvanized ice cans. Aluminum is readily attacked by an alkaline substance or alkaline brine unless a sufficient quantity of the inhibitor is present. Zinc on ice cans is attacked when brine pH is above 9.0. A treated brine kept between a pH of 7.5–8.5 is most desirable.

When using sodium bichromate, 100 lb per 1000 cu ft of brine (7500 gal), it is important to follow with about 27 lb of caustic soda to form the normal chromate. Sometimes the brine solution contains enough alkali to convert the bichromate over to chromate without adding the full amount of caustic soda. The pH and titration adjustment of a sample readily discloses the proper amounts to add.

Regular tests and adjustments must be made to maintain the correct inhibitor concentration and keep the brine at the desired pH. (See "How to Test Brine For Refrigeration," May POWER.) To aid in making the tests and adjusting the solution, I devised a simple but comprehensive chart, which is reprinted on page 134 as Data Sheet No. 142. It enables me to determine quickly and accurately the proper amounts within reason of sodium hydroxide (caustic soda) or sodium bichromate, to add to the brine when its pH and quantity are known.

Further developing this chart, I converted it to disk *B*, shown here, using the same figures, but taking in a wider range—that is, ½ to 6 instead of 1 to 3 cc. These two examples explain how the disk works: (1) brine having a pH of 6.9 and (2) brine having a pH of 9.5 are both to be corrected to pH 8.0.


A
B
Amount of sodium bichromate pounds per 1000 gallons in hydroxide needed to neutralize pH of brine
Amount of sodium pounds per 100cc
Amount of ½% 100cc

Disk *B* makes a handy tool for the plant operator when it is mounted on cardboard and fitted, as sketched, with open-segment cover *A*, also of cardboard

(1) While agitating 100 cc of a clear brine (original pH 6.9) add to it enough decinormal sodium hydroxide (N/10 NaOH) with a calibrated pipette or burette to bring the sample to a pH of 8.0. Record the number of cc of N/10 sodium hydroxide added. Assume it is 2.7 cc. Locate 2.7 cc on the disk's inner circle of figures and follow it to the middle circle in the same segment. Read 0.901 lb of caustic soda (sodium hydroxide) needed per 1000 gal of brine to bring it up to a pH of 8.0.

(2) While agitating 100 cc of a sample (original pH 9.5) add to it decinormal hydrochloric acid (N/10 HCl) until the solution reaches a pH of 8.0. Assume it to take 2.9 cc. Locate 2.9 on inner circle of figures to find that it requires 3.580 lb of sodium bichromate per 1000 gal of brine (outer circle) to bring the pH to 8.0.

This disk makes a handy and simple tool for plant use. Construct it thus:

1. Divide a 5½-in. circle of paper into 60 segments.

2. Place the number of cc (subdivided into tenths) on each segment 1 in. from the center.

3. Place the lb of caustic soda per 1000 gal of brine (corresponding to the cubic centimeters of N/10 sodium hydroxide needed to adjust the brine's pH) 1½ in. from the center of each segment. Use black ink.

4. Place the lb of sodium bichromate per 1000 gal of brine (corresponding to the cc of N/10 HCl needed to adjust the brine's pH 3 in. from the center. Use red ink.

(5) Cut two 5½-in. circles out of flexible but strong cardboard to serve as a cover and backing for the printed paper.

(6) Cut a 6-deg segment from the cover to within ¾ in. of the center so that the desired figures of the inner circle may be seen with cover on.

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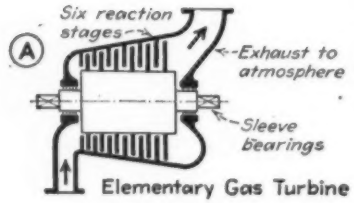
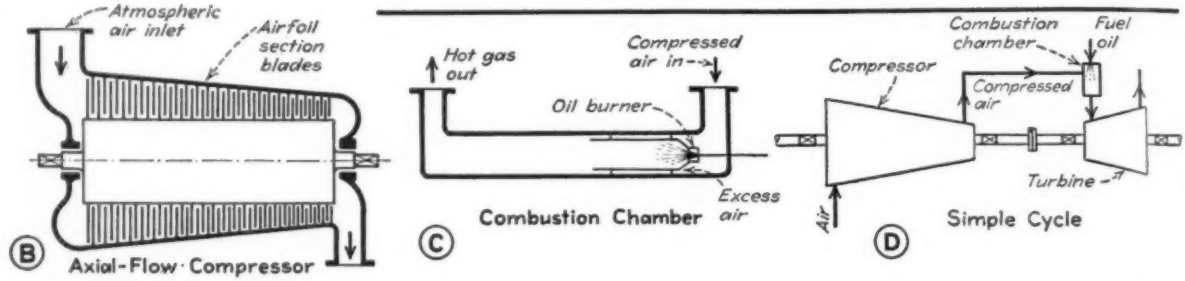
American Contribution to Gas Turbine Development—I

By C C JORDAN, *Manager*
Central Station and Marine Dept
Allis-Chalmers Mfg Co



Some Houdry units have operated continuously from six months to two years with no maintenance problems that would not be expected of steam turbines. Future development depends on solutions to certain design problems



Basic gas-turbine unit is an assembly of multi-stage reaction turbine *A*, multi-stage axial-flow compressor *B*, and elongated cylindrical combustion chamber *C*. For simplicity, these elements are represented schematically as in *D*

▶ OUT OF THE MANY THOUSANDS OF HOURS piled up by gas turbines in several years of actual commercial operation, there should come some indication of where we are and where we are going in this field. We do know, for example, that the Houdry units have presented no maintenance problems that would not have been expected of steam turbines. Some have operated continuously from six months to two years.

The whole subject of gas turbine development now occupies a spotlighted position on the engineering stage. Popular magazines and feature writers have discovered the "rotating diesel" (a principle known for 2000 years) and hailed present development as likely to change the entire field of power generation. Perhaps some radical revolution in power and propulsion machinery will come to pass, but if the gas turbine is to play the leading role, we will have to wait for our chief actor to grow out of his swaddling clothes.

What is this gas turbine? Is it out of the experimental stages? What specifically can it do? When will I be able to buy one? How much will it cost? These are not the only questions to which designers must find answers before the future pattern becomes plain.

In 1938, Allis-Chalmers started building the only type of gas turbine that has attained any commercial success in this country. Basic designs were developed by Brown Boveri in Switzerland. The first units were built according to their specifications, but modifications made subsequent machines more suitable for American conditions and eventually complete new designs were placed in successful operation.

All of these machines are built to supply large volumes of air (23,000 to 60,000 cfm) to Houdry gasoline cracking plants. Since they are an integral part of a complicated chemical process, their sole function is to furnish pressure air at a lower cost than afforded by any other means. Excess power is purely incidental. Some 28 of these units have been built by Allis-Chalmers and more are on order.

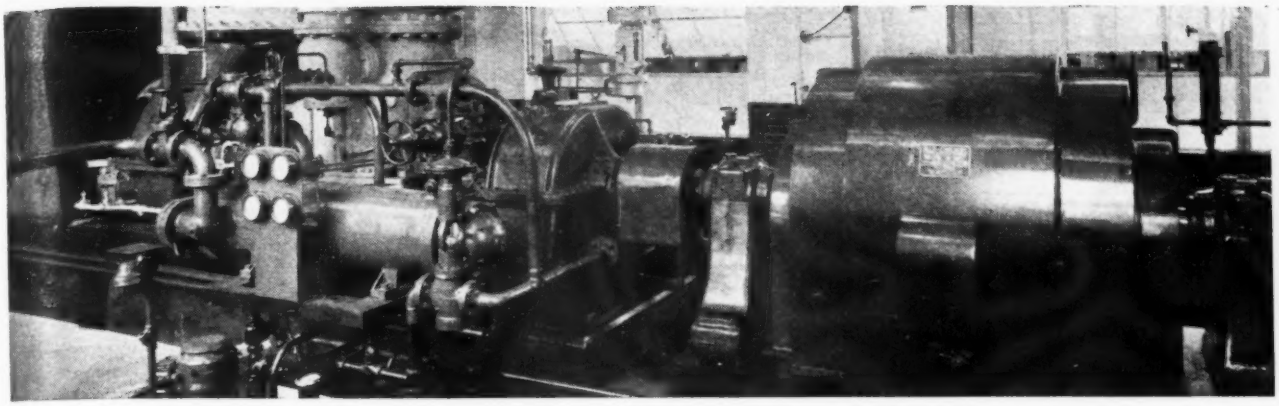
From a background representing practically all the American experience in building commercial gas turbines, Allis-Chalmers feels that these machines, except the specific Houdry units, are still in an experimental stage but that their future is indeed promising. However, both engineering and metallurgical problems remain to be solved.

Houdry units, built primarily for supply of pressure air, differ somewhat from gas turbines one would build for high-efficiency power generation. However, a description of the power unit might well start with a detail of the basic elements of the Houdry type.

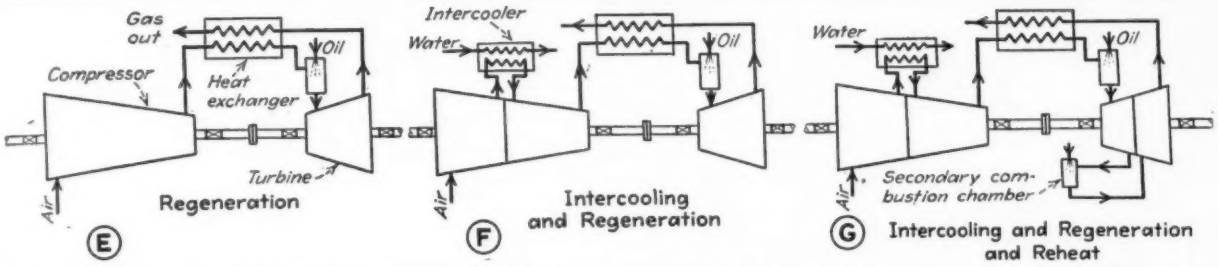
Fig. *A* shows a cross-section of the gas-turbine element of a Houdry unit. Similar in construction to a reaction steam turbine, blades are mounted on a solid rotor and in a casing. Unlike a steam turbine, however, the only control valve needed is one which the emergency governor opens at overspeed to bypass hot gas directly from the turbine inlet to exhaust. While designs may vary materially from that in Fig. *A* toward conventional impulse or impulse-reaction construction, the multi-stage turbine element is a basic part of any gas-turbine power unit.

The second necessary part, as important to the gas cycle as the boiler is to a steam power plant, is the compressor. Fig. *B* shows a schematic section of an axial-flow compressor of high efficiency. Similar in design to a reaction steam turbine, the gas turbine has rotating blades mounted on a hollow drum and stationary blades supported in a casing. The compressor may, of course, be of any conventional design, but must be highly efficient, say, above 80%, if the over-all unit is to have an acceptable thermal efficiency.

To heat the pressure air leaving the compressor to whatever temperature the gas-turbine blading can stand, a combustion chamber, such as Fig. *C*, is required. A wide variety of designs are possible; that illustrated is used to test Houdry units at the factory. (After installation the catalyst chambers supply all necessary heat.) Only requirement



Gas-turbine compressor set as now built for Houdry refineries. Several years of actual operating experience are available



Fuel efficiency is greatly improved by adding heat exchanger *E*, still further benefited by intercooling between stages of compressor *F*, and can well borrow the advantages of reheat from steam cycle by direct oil firing *G*

of the combustion chamber is that air and fuel be burned in correct mixture to bring products of combustion to a specified temperature with negligible pressure drop between compressor exhaust and turbine inlet.

If the basic elements are put together, the result becomes a simple gas-turbine power unit. Output can be absorbed in an electric generator or in the propeller of a ship or any type of driven apparatus. This simple cycle, diagrammed in Fig. *D*, is capable of approximately 17% efficiency (15,000 Btu per hphr) with a gas temperature of 1200 F.

The first obvious move to increase thermal efficiency is to recover some of the heat in the turbine exhaust by adding a heat exchanger, Fig. *E*, to heat the air between compressor exhaust and combustion chamber. With this regenerative cycle, the gain in thermal efficiency depends on the amount of heat-exchanger surface. Pressure drop in this exchanger must be a minimum to avoid efficiency loss of the entire unit.

A further gain in efficiency is made by intercooling between stages of the compressor, Fig. F, just as intercooling improves efficiency of any air compressor. Still better over-all performance can be had by reheating between stages of the gas turbine. This is best represented, Fig. *G*, by assuming that the turbine is divided into high- and low-pressure elements with reheating accomplished in a second combustion chamber between high-pressure turbine exhaust and low-pressure turbine inlet. Combustion gas, containing much more than enough excess air to burn the fuel, is raised to about the same temperature as that of the gas going into the high-pressure turbine.

This brief elementary summary answers the question, What is a gas-turbine power unit? No matter what specific design of turbine, compressor, combustion chamber and heat exchanger is devised, these basic elements correspond to the boiler, turbine, condenser, heaters and feed pump of the elementary steam power plant. For accessories to the gas-turbine unit there will be a lubrication system with its oil cooler, a governor system for controlling fuel flow to the combustion chamber, a fuel-feed pump and a starting motor, or some similar means of bringing the shaft up to about 25% normal speed.

Turning to the future of gas-turbine power units, we now know that the Houdry sets have been exceptionally reliable. Apparently gas-turbine design has progressed far enough to meet the specific requirements of this application. However, the refineries operate at the lowest possible temperature to keep maintenance on the entire plant at a minimum. This results in normal operation of the gas-turbine set at 850 to 900 F maximum. For these conditions the turbine design and blade materials have been adequate. The blade alloy contains chromium, nickel, tungsten, columbian, titanium and molybdenum.

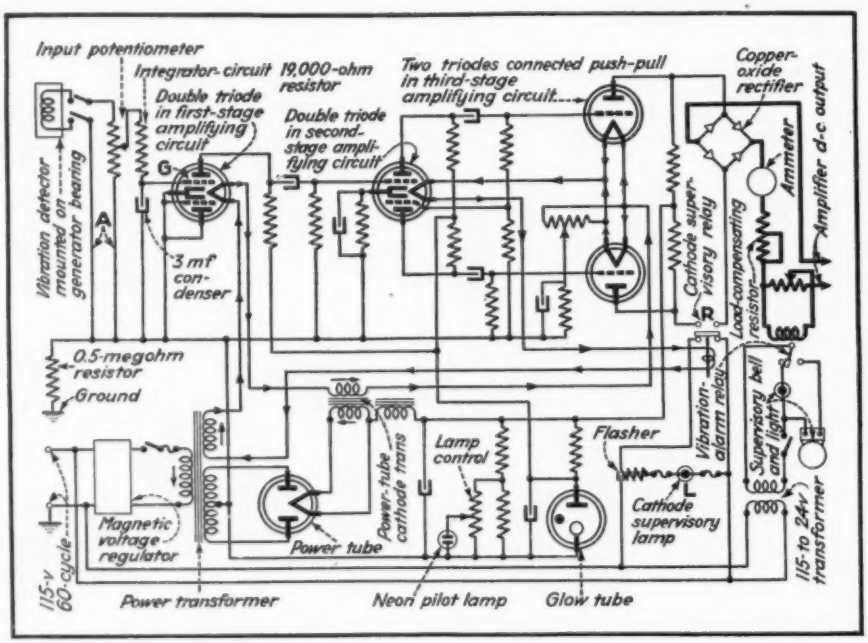
If the gas-turbine power unit is to become a commercial success in other applications, gas temperatures in excess of 1000 F must be employed or thermal efficiency would be too low to be attractive. This poses an entirely new set of questions for the designer before the real future of the gas-turbine unit can be evaluated. These might be enumerated as follows: (1) Are alloy steels available for the turbine casing and blading to permit initial gas temperatures of 1200 to 1500 F? (2) Will maintenance become excessive on such alloys at these temperatures? (3) What efficiency *guarantees* can be made? (4) What governing characteristics can be expected? (5) Will coal burn successfully instead of gas or oil? (6) What sizes can be built? What cost?

At present these questions offer a field of speculation without the necessary experience to establish precise answers expected of an engineering analysis. Until answers of a "yes" and "no" variety can be given, the true picture of the gas turbine's future will remain undeveloped. Enough progress has been made, however, to give a faint outline of what the picture may become.

Mr Jordan will discuss answers to these questions in July POWER. *(Editor)*

Improved Operating Practice for Steam Turbine-Generators

You can prevent damage to turbine-generator bearings and rotor field windings by an electronic vibration detector and by preheating the field winding, say these AIEE papers



Connection diagram of steam-turbine-generator vibration detector and its electronic amplifier, which causes the generator to be disconnected from the power system and which can shut down the machine if it develops dangerous vibration

► ELECTRONIC EQUIPMENT received major attention at the two-day American Institute of Electrical Engineers' Northeastern District Technical Meeting, April 19 and 20, in Boston, Mass., where 15 of the 45 papers at the seven technical sessions dealt with the subject.

"*Vibration Protection of Rotating Machinery*," by R L Webb and C S Murray, Consolidated Edison Co of New York, holds particular interest for power-plant engineers. It describes in detail an electronic system for protecting large steam turbine-generators against excessive vibration, such as might develop from grounds or short circuits in their field windings.

This system operates relays which function quickly to initiate circuit-breaker operation to relieve the fault. On synchronous generators the main and field circuit breakers are tripped instantaneously and prime-mover power shut off if desired. This system consists of a seismographic vibration detector mounted on the generator bearing, an integrator circuit, an electronic amplifier, alarm and protective relays, vibration recorder and supervisory circuits. The diagram shows their general arrangement.

The vibration detector has a strong, permanent magnet supported on springs that are the stationary element. A light coil supported from the detector's base is free to move in the magnet's field when this base is subjected to vibration. The detector is mounted rigidly on the generator's bearing, or other part, where vibration is to be measured. When the coil vibrates in the magnetic field it generates an alternating voltage.

As the diagram shows, the detector's coil connects to the first stage of amplification through an integrator circuit consisting of a 19,000-ohm resistor and a 3-mf condenser. Output from the detector connects to a complete circuit. *A*, while the voltage drop across the condenser is applied to grid *G* of the first-stage amplifying tube and governs operation of the relays.

Resistance of the detector circuit predominates the capacitive reactance except at low frequencies; consequently current in the circuit remains nearly constant with constant voltage for any frequency of vibration at which generator protection is desired. For a given vibration amplitude, voltage generated by the detector is directly proportional to frequency of vibration. Condenser capacitive reactance is inversely proportional to frequency. Therefore, voltage drop across the condenser does not change with different frequencies, consequently is proportional to vibration amplitude alone.

Detector Accuracy

The detector has been designed to produce a voltage output nearly proportional to vibration amplitude over a wide frequency range. At 30 cycles and above, this error is negligible. This is important because it is not vibration frequency that is to be protected against, but its amplitude.

The amplifying circuit has three stages, obtained in two double-triode tubes and a third stage using two triode

(*Continued on page* 136)

ASME, PITTSBURGH JUNE 19-22

Semi-annual meeting of American Society of Mechanical Engineers, at William Penn Hotel, will include papers on fuel choice, coal segregation, heat insulation, slag, small anthracite, "packaged" power plants, cooling towers, heat exchangers, turbine research and pumps.

DIESEL INJECTION

TAKING midland boys who'd never seen an ocean and making sailors out of them is a job the Navy mastered years ago. But they've had to learn new training tricks in this war — a war fought with mechanical devices of infinite complexity.

For example, just one part of the job was making good crewmen for the vast fleet of diesel-powered craft out of boys who'd never gotten close enough to a diesel to touch it. Working on the sound theory that *know-how* comes easiest from *seeing how* things work, they literally brought the Navy's varied diesel equipment into the classroom by a unique series of picturizations. With the aid of equipment manufacturers, and working from cutaway models, photographs and blueprints, a staff of specialists at the Naval Training Aids Development Center in New York completed more than 500 carefully detailed drawings of engines, engine parts, and accessory equipment. These served as the nucleus for courses given at the various training centers.

Enormously impressed with both the sound philosophy of this training method and the superb artistry with which it was executed, we asked permission to bring part of this material to our readers. It forms the basis for this 47th POWER special section, on diesel injection. All illustrations come from the Navy series, modified for suitable reproduction, and POWER editors prepared the brief text that ties the pictures together. Where the Navy series does not include certain types of equipment we have supplied descriptions, and to aid the reader in identifying the systems we have departed somewhat from our usual special-section practice and mentioned manufacturers' names.

WITH such a wealth of material to draw upon, it proved necessary to select some single phase of engine design for comprehensive treatment, hence the subject—injection systems. Injection equipment forms a common element in all diesels and no single device plays a bigger part in influencing engine performance.

The fuel-injection system performs four essential functions: (1) It delivers oil from storage system to spray nozzle, (2) It raises fuel pressure to level needed for atomization, (3) It measures and controls amount of fuel delivered to the cylinder each cycle, and (4) It controls time of injection. Precision required can be gaged from the fact that in a high-speed engine quantity of fuel to be metered and delivered each cycle may be in the neighborhood of half- to one-thousandth of a pound and the job must be done in a matter of hundredths or thousandths of a second.

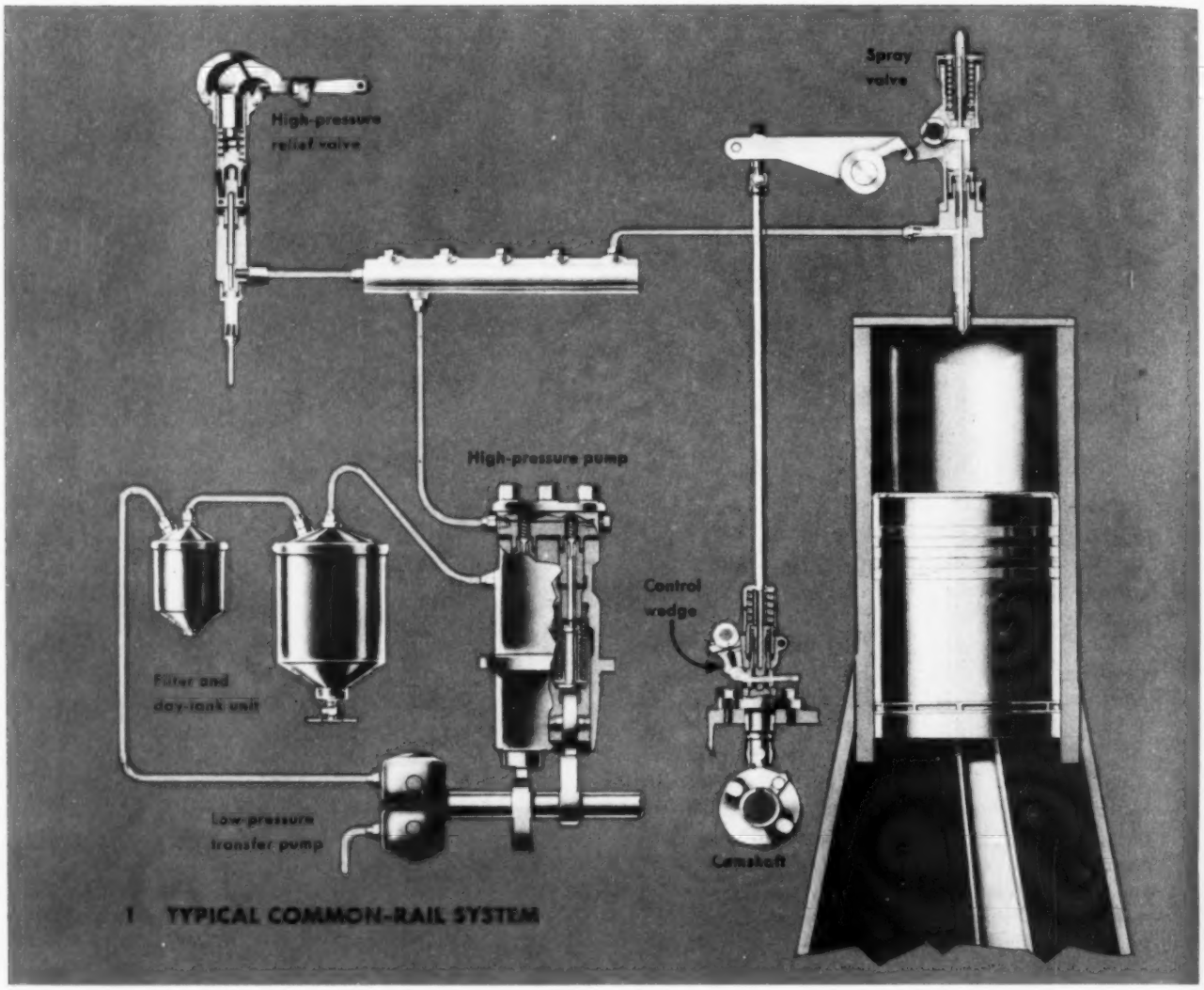
Most diesels built today use some form of mechanical injection in place of the original air-injection method devised by Dr. Diesel. Pumps and spray nozzles form the basic elements of any mechanical-injection system. These have been combined in many ways, but existing equipment falls into three main classes: (1) common-rail, (2) distributor, and (3) pump-injection systems.

In the common-rail system, a single pump supplies high-pressure fuel to a header from which run lines to individual spray nozzles. The pump supplies more fuel than needed; relief valves return excess and maintain constant header pressure. Valves in the fuel nozzles control amount of oil injected and time of injection; valves are usually mechanically operated.

In distributor systems, a single pump raises oil pressure, meters fuel charge and controls time of injection. A distributing device directs the fuel charge to the proper cylinder, thus making it possible for one pump to serve a multi-cylinder engine.

Pump-injection systems differ from the foregoing in that an individual pump or pump cylinder serves each engine cylinder, connecting directly to the fuel nozzle. The pump meters the charge and controls injection timing. The nozzle usually contains an hydraulically actuated valve which opens automatically when injection pressure is reached and closes when pump delivery ceases.

The following pages describe, largely by means of the exceptionally clear and detailed pictures, operation of typical examples of each system. We believe they are unique in diesel educational literature. Use them to refresh your own knowledge of injection practice and to train younger engineers.



1 TYPICAL COMMON-RAIL SYSTEM

COMMON-RAIL SYSTEMS

The injection system of Atlas-Imperial engines typifies the common-rail principle. As illustrated schematically above (1), a low-pressure transfer pump delivers fuel from the storage tank to a combined filter and day-tank unit. The transfer pump delivers an excess of oil under all conditions and the surplus flows back to the main supply tank through a relief valve on top of the filter (not shown). The relief valve acts as a safety valve if the filter clogs and also rids fuel of any entrained air. Another pipe (not shown) leads from the top of the day tank back to the storage tank; it also carries a vent and a relief valve. The atmospheric vent has a check valve which prevents outward fuel flow and permits inward air flow when the hand priming pump is used before starting the engine and the day-tank contents are drawn upon for a fuel supply to prime the injection system.

These arrangements maintain a constant supply of clean solid fuel, under slight pressure, in the line leading from the bottom of the day tank to the high-pressure pump. This latter unit may have one or more plungers driven from the pump crankshaft which is, in turn, driven from the engine crankshaft. Plungers are hardened, ground and lapped in their bushings and require no packing. Suction and discharge valves are at the top of the pump.

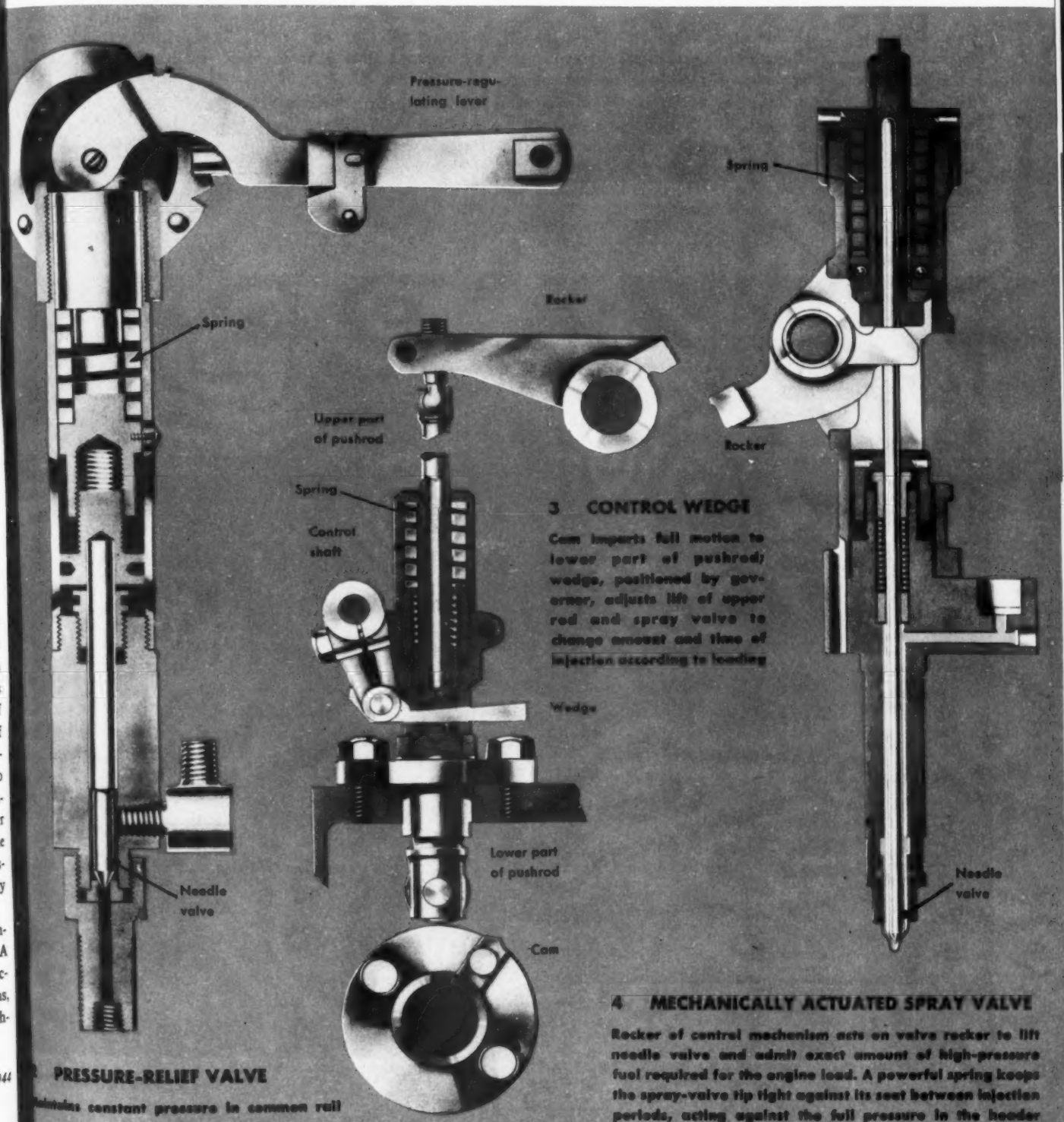
This pump delivers a constant quantity of fuel to the common rail or header. The amount depends on engine speed, and is always more than the engine can use even when overloaded. From the header, individual connections lead to the mechanically operated spray valves; a shutoff in each branch permits cutting any single cylinder out of action if necessary. At one end of the header is a connection to a pressure gage and to a reservoir which helps to soften any pressure fluctuations and thus aids in maintaining the constant header pressure desired for proper injection conditions. Connected to the other end of the common rail, a high-pressure relief valve regulates pressure at desired level. Surplus fuel goes back to the supply tank by a line not shown.

As can be seen in the detail illustration (2), the high-pressure relief valve is a spring-loaded needle valve. A lever at the top of the valve provides for adjusting injection pressure according to changes in operating conditions, by varying spring tension. A quadrant and ratchet mechanism locks the lever in any position.

Fuel from the common rail flows through strainers to the mechanically operated spray valves, which are spring loaded and actuated by rockers and pushrods from cams on the engine camshaft. Quantity of fuel injected depends on fuel pressure and on amount and duration of spray-valve lift. The lever on the high-pressure relief valve regulates fuel pressure; a two-part pushrod and wedge mechanism controls amount and duration of spray-valve lift.

The detailed illustrations (3 and 4) show the control mechanism clearly and its relation to the spray valve. The cam always imparts full motion to the lower part of the pushrod, but the position of the wedge piece between determines the motion of the upper rod and hence of the spray valve. A control shaft running the length of the engine and under governor control, positions the wedge pieces, one for each cylinder. These wedge pieces give accurate adjustment of valve lift and any reduction in lift also tends to retard time of beginning injection and total time valve is open. A powerful spring keeps the spray-valve tip tight against its seat between injection periods.

Cooper-Bessemer engines employ what is known as a controlled-pressure or pressure-relief system, which differs in several respects from the typical common-rail design. The drawing on the next page (5), shows arrangement of principal parts. A transfer pump draws fuel through strainers to the day tank; excess fuel returns to the storage



3 CONTROL WEDGE

Cam imparts full motion to lower part of pushrod; wedge, positioned by governor, adjusts lift of upper rod and spray valve to change amount and time of injection according to loading

4 MECHANICALLY ACTUATED SPRAY VALVE

Rocker of control mechanism acts on valve rocker to lift needle valve and admit exact amount of high-pressure fuel required for the engine load. A powerful spring keeps the spray-valve tip tight against its seat between injection periods, acting against the full pressure in the header

PRESSURE-RELIEF VALVE

Maintains constant pressure in common rail

tank by way of an overflow pipe. Fuel flows by gravity through a duplex strainer to the pressure pump, which delivers to the common rail or header. Individual lines lead from the header to pressure-relief and timing valves, one to a cylinder, and thence to the spray valves.

The detailed illustrations (6 and 7) show pump construction, which features built-in pressure-regulation, and relief and timing valves. The pump drawing (6), shows a section through one of the two cylinders fitted with hardened and lapped plungers, and through the pressure-regulating system. The plunger has a constant stroke, discharging against a spring-loaded check valve into a reservoir or accumulator bottle to minimize pressure fluctuations.

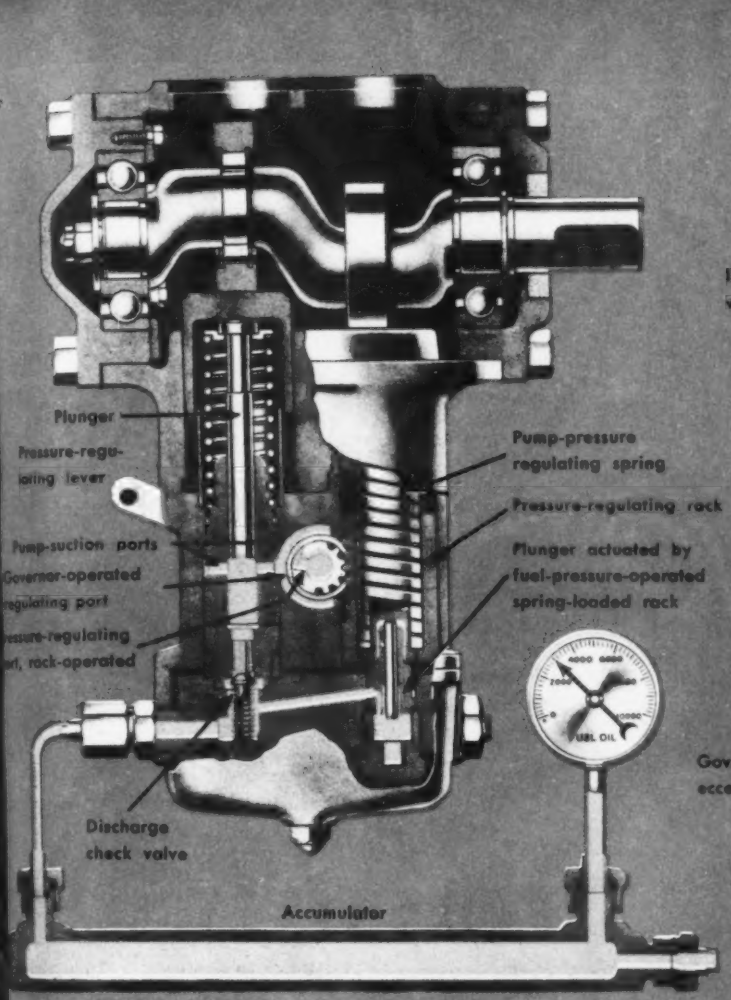
Fuel enters the pump at the rear, flowing into the plunger barrels through a central passage fitted with a regulating valve and sleeve. The lever, shown in the low-pressure position, adjusts the sleeve's position, under manual or governor control. Position of the ported valve depends on action of a rack on a spring-loaded plunger, against which fuel pressure acts through a passage from the discharge-valve chamber. Thus a change in fuel pressure alters the position of the plunger and its rack and turns the regulating valve, changing the relation between the valve port and the port in the sleeve. The net effect is an adjustment of pumping rate to maintain desired pressure as fixed by the regulating-lever position.

The pressure-relief and timing valves represent a unique feature of this system. These are grouped in blocks of three for six-cylinder engines and of four for eight-cylinder engines. Cams, on a special shaft just below the main camshaft and driven from it by gears, actuate the valves. These valves control the quantity of fuel injected into each cylinder and relieve the pressure on the line to the cylinder between successive injections.

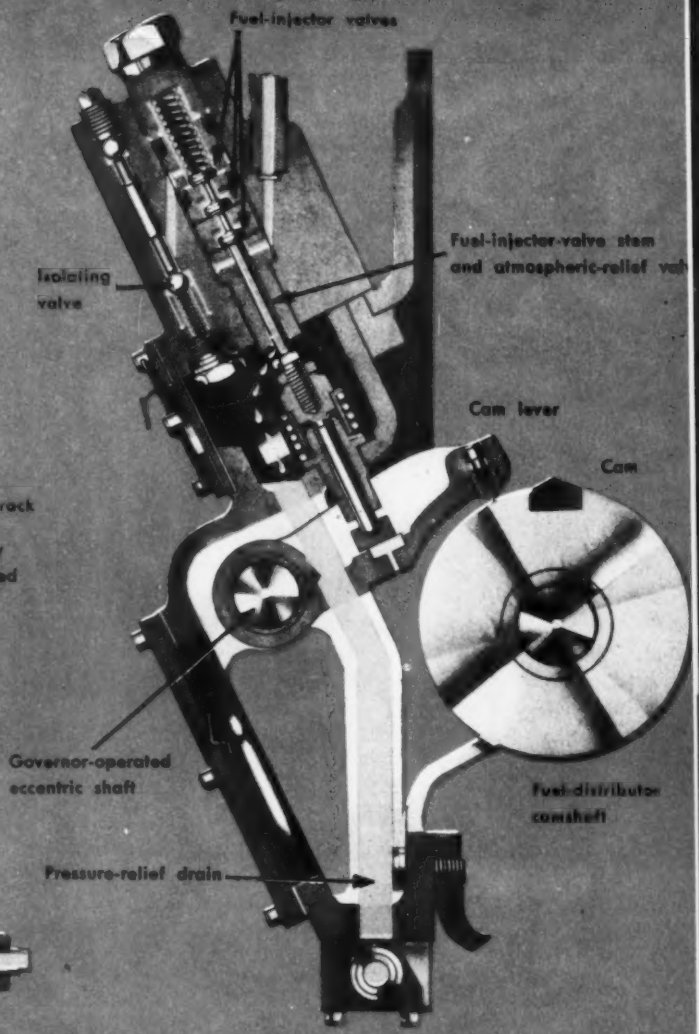
Construction of the pressure-relief and timing valves is shown in the detail (7). High-pressure fuel enters the body through a ball-check isolating valve and flows to triple spring-loaded injection valves. Lift of these results from tappet motion, actuated by the cam. Between tappet and cam there is a lever mounted on a governor-operated eccentric shaft. Thus governor action changes lever position and valve lift and timing. This, with the fuel-pressure control in the pump, gives complete control of the quantity of fuel injected.

When the injection valves seat, a passage through the injection-valve stem connects the discharge chamber to atmospheric pressure and a pressure-relief drain back to the storage tank. This relieves the spray valve of constant header pressure between injection periods, giving a sharp cutoff

5 CONTROLLED-PRESSURE SYSTEM
This system differs from the typical common-rail design in that built-in pump regulation maintains set header pressure and pressure-relief and timing valves are interposed between pump and spray valves, which act merely as checks
Fuel line
Spray valve
Cam
Pressure pump
Pressure gage
Pressure-relief and timing valve
Accumulator
Fuel line



6 PUMP WITH BUILT-IN PRESSURE REGULATION



7 PRESSURE-RELIEF AND TIMING VALVE

to injection and preventing any possibility of dribbling.

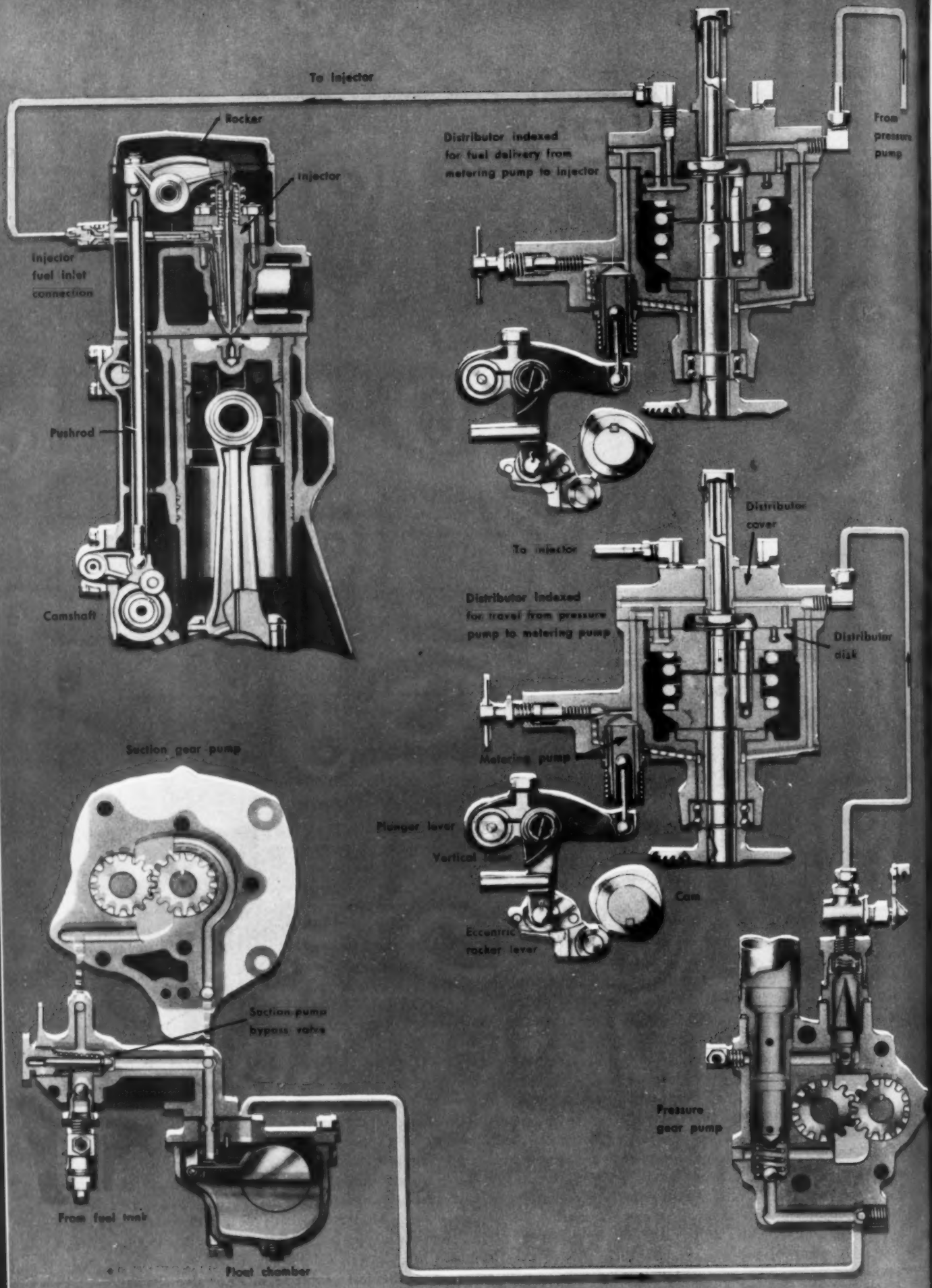
With control of injection timing and quantity placed in a separate valve, the spray valve need only be a spring-loaded check valve. When the injection valve lifts to admit high-pressure fuel to the spray valve, its needle rises against the spring and when pressure is vented to atmosphere the spring snaps the needle shut smartly.

The common-rail system employed on heavy-duty Superior engines, not illustrated, features pressure control at the pump and lift and timing control by means of a wedge in the valve mechanism. In brief, this system comprises a transfer or service pump delivering oil from storage to day tanks, whence it flows by gravity to a pressure pump fitted with two or three lapped plungers driven by double-lobed cams. Each plunger has one or two spring-loaded discharge valves and dual suction valves whose seating is under control of a fuel-pressure regulator. This consists essentially of a small plunger, one end of which is exposed to fuel pressure and the other loaded by a spring whose tension is adjusted by a speed-control lever for marine work or by means of an adjusting screw for stationary units. There is a safety valve on the fuel manifold to prevent excessive pressure and a pressure-relief valve to release pressure in the manifold automatically to a predetermined amount necessary for smooth starting each time the engine stops or reverses.

Individual lines, with shutoff valves, lead to the mechanically operated spray valves. The overhead camshaft actuates a rocker arm which, in turn, actuates a rocker on the spray valve. Between the two rockers a fuel wedge is inserted; as the governor changes the wedge's position the spray-valve lift and timing changes.

Common-rail systems offer the advantages of simplicity and ease of maintenance. Good fuel economy and high bmep can be obtained and engines fitted with this system are usually able to carry substantial overloads in emergencies. If excessive load causes the speed to fall, fuel supply to the cylinder increases because the period when the valve is open remains constant in degrees of rotation but increases in time interval. Thus torque tends to increase with reduction in engine speed, a definite advantage in some applications.

Early disadvantages of common-rail systems arose from troubles with packings used to seal pump plungers and spray valves. Modern methods of grinding and lapping make packing unnecessary and eliminate this trouble. The common-rail system is not well suited to high speeds because of mechanical problems in the valve linkage.



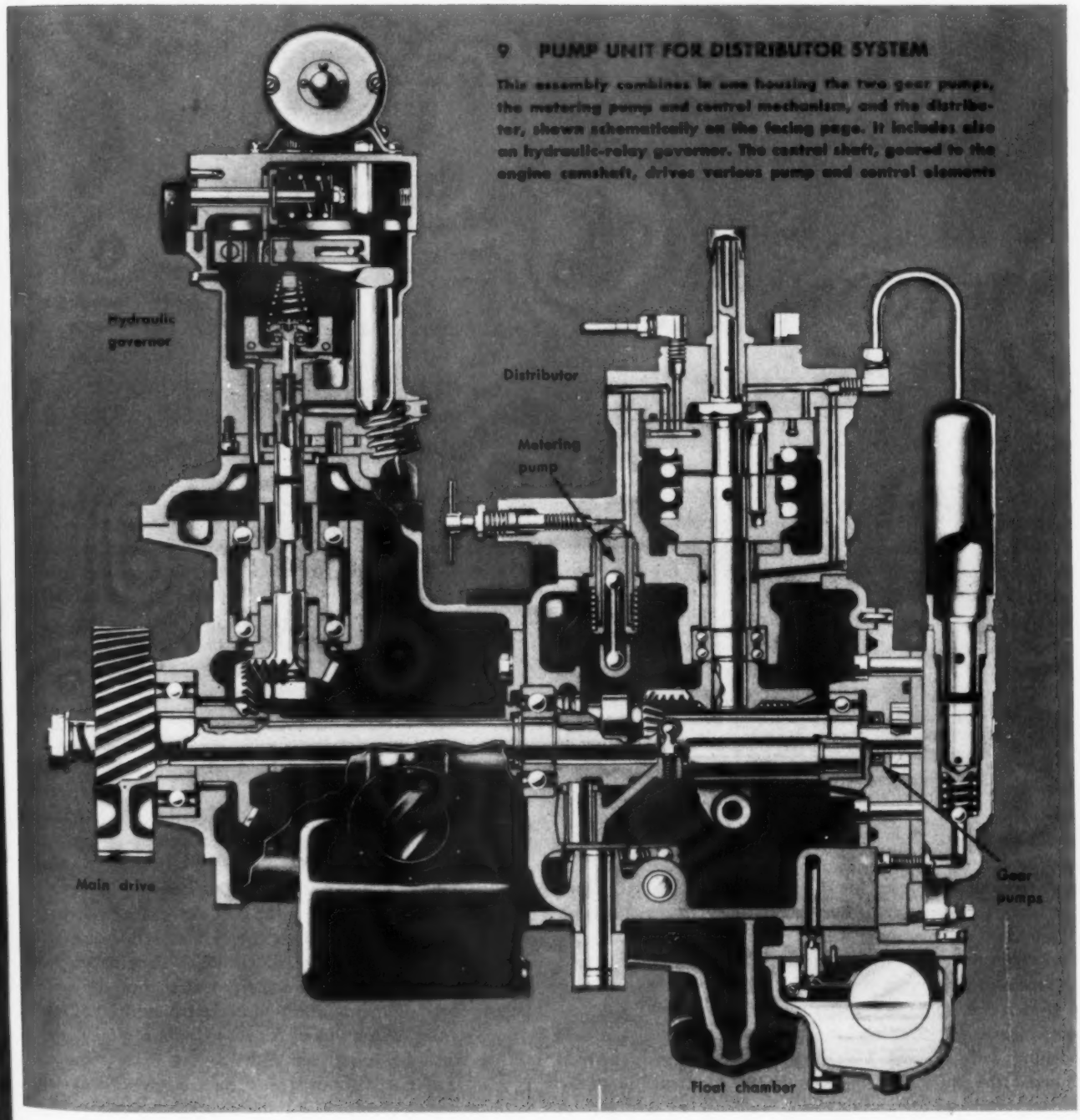
8 SCHEMATIC ARRANGEMENT OF ELEMENTS COMPRISING ONE FORM OF DISTRIBUTOR SYSTEM

DISTRIBUTOR SYSTEMS

In a typical distributor system, a single pump raises fuel pressure, meters the fuel charge and controls time of injection. A distributing device directs the fuel charge to the proper cylinder, thus making it possible for the single pump to serve a multi-cylinder engine.

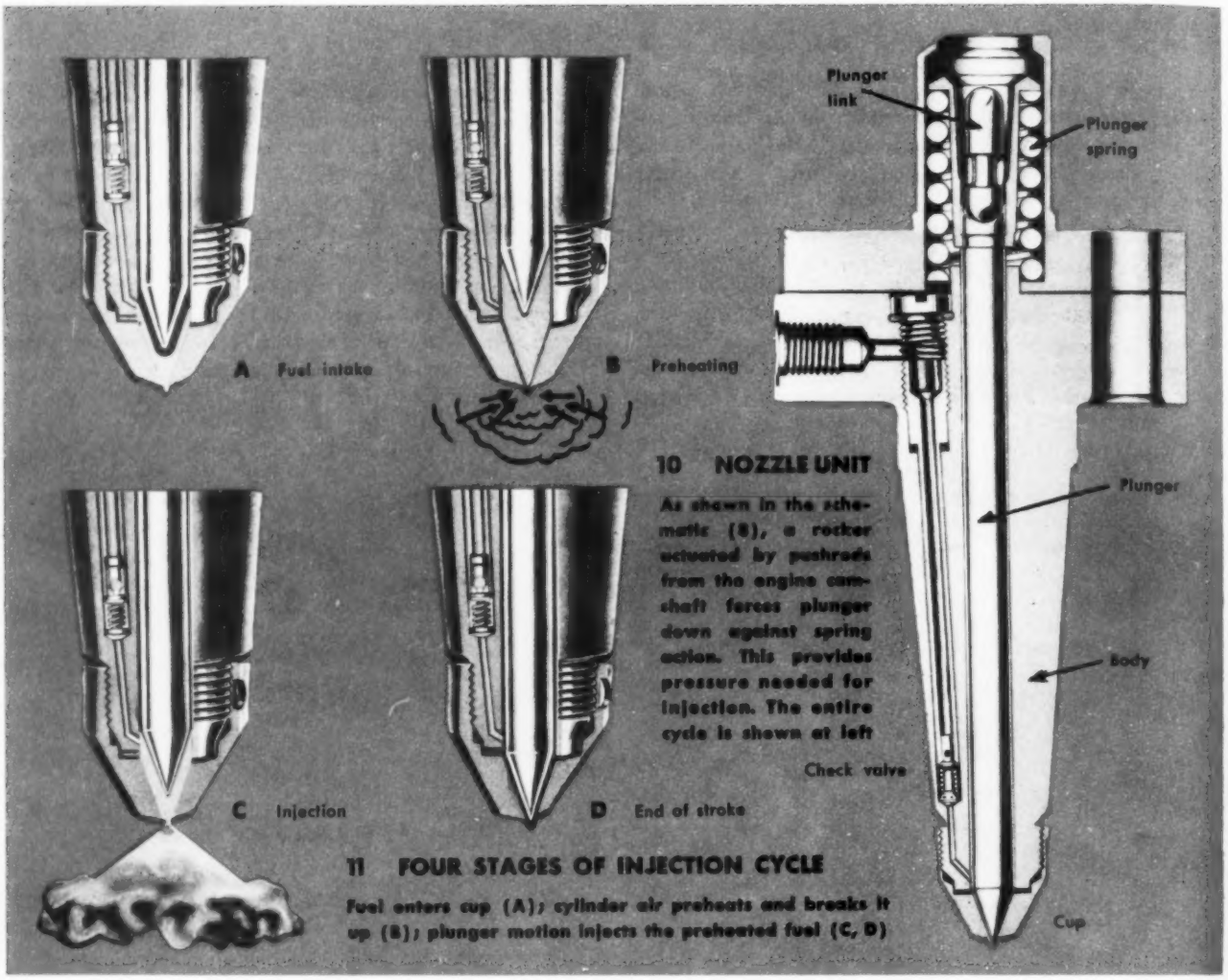
The Cummins injection system, illustrated on the facing page (8), uses the distributor principle; it differs from other distributor systems in that all pumping, metering and distributing operations take place at low pressure, the needed injection pressure being built up in the special nozzles. As shown, a gear suction pump lifts fuel from the tank and delivers it to a float chamber from which a second gear pump delivers it, at low pressure, to the distributor.

The distributor consists of a rotating disk and a stationary cover to which fuel lines running to individual injectors connect. Disk and cover carry a series of holes which, when properly indexed, form passages from the fuel supply pump to the metering pump. This occurs when the metering plunger moves down on its suction stroke and thus permits the pump barrel to fill with oil. The disk continues to rotate and lines up with the correct discharge hole in the cover just as the metering plunger rises by action of the main fuel-pump cam. This forces the fuel to the proper injector line.



9 PUMP UNIT FOR DISTRIBUTOR SYSTEM

This assembly combines in one housing the two gear pumps, the metering pump and control mechanism, and the distributor, shown schematically on the facing page. It includes also an hydraulic-relay governor. The control shaft, geared to the engine camshaft, drives various pump and control elements



10 NOZZLE UNIT

As shown in the schematic (8), a rocker actuated by pushrods from the engine camshaft forces plunger down against spring action. This provides pressure needed for injection. The entire cycle is shown at left

11 FOUR STAGES OF INJECTION CYCLE

Fuel enters cup (A); cylinder air preheats and breaks it up (B); plunger motion injects the preheated fuel (C, D)

The metering pump is a closely fitted reciprocating unit, obtaining its motion through a link from the plunger lever. A vertical lever, controlled by an eccentric rocker lever running directly off a cam on the fuel-pump main shaft, operates the plunger lever. The position of the vertical lever in the eccentric of the rocker lever determines the plunger-lever travel and consequently the metering-plunger travel, and thus the amount of fuel going to the cylinder.

A governor linkage moves the vertical lever between the stop pins in the cam-rocker lever. When the roller is against the inside stop pin there is no travel on either vertical lever or metering plunger and no fuel goes to the engine. If the vertical lever moves to the outside pin, the stroke of the metering plunger becomes sufficient to deliver fuel for full speed and load.

As actually constructed, both gear pumps, the distributor, metering pump and governor combine in a single unit, illustrated on the preceding page (9). A single central shaft, geared to the engine camshaft, drives the various elements of the pump assembly.

Under control of the distributor, fuel enters the Cummins nozzle (10), at low pressure, passing through a side opening with a check valve to the space or *cup* formed between the plunger and nozzle tip. The central plunger is forced down against spring action by a rocker actuated by pushrods from the engine camshaft (see schematic, pg 84).

The four nozzle-tip diagrams (11) show the injector action. Starting with the fuel line and passage to the cup full of fuel, on the intake stroke the metering pump forces a fuel charge into the cup (A). The fuel lies in the cup through the engine compression stroke and the compressed air forces its way through the small spray holes in the injector (B). Intense heat and blasting of compression preheats and breaks up the fuel in the cup.

A few degrees before top center, the mechanically operated fuel plunger starts down and drives the preheated fuel charge out into the cylinder (C). The plunger moves to the end of its down stroke (D) and the cycle repeats. The check valve and the plunger prevent compression from blowing the fuel back and filling the lines with air.

In the International Harvester distributor system, a single port-controlled pump, of the type to be described in some detail later, meters the fuel charge and raises pressure. Distribution of fuel to the cylinders in proper firing order is accomplished by independent distributor valves actuated by the pump camshaft, which runs at one-half engine speed. Time of injection is controlled by the master pump and is thus uniform for all cylinders.

The Rathbun-Jones engine, using the Price combustion system, employs a rotating-disk distributor in conjunction with a single pressure pump, bypass-valve controlled.

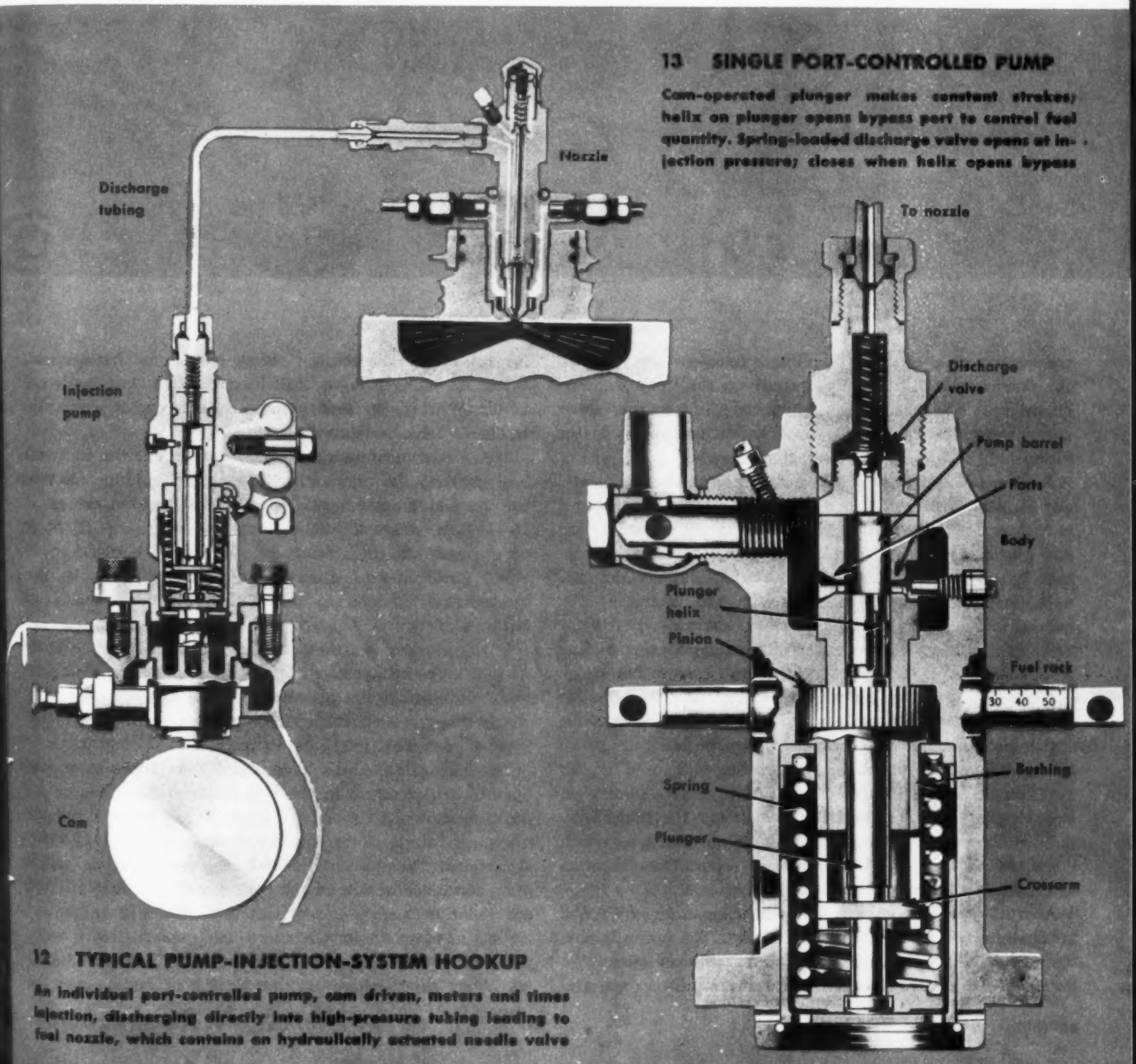
PUMP-INJECTION SYSTEMS

Pump-injection systems, sometimes called "jerk-pump" systems, differ from those previously described in that an individual pump or pump cylinder serves each engine cylinder, connecting directly to the fuel nozzle. The pump meters the charge and controls injection timing; the nozzle contains a valve which opens when injection pressure is reached and closes when pump delivery ceases. The typical system shown below (12) consists of a cam-operated pump, a connecting tube and a fuel nozzle. In this case, an identical arrangement serves each cylinder.

Most of the differences in pump-injection systems lie in the pumps. There are two basic types: constant-stroke and variable-stroke. Most designs operate on the constant-stroke principle, using port arrangement, spill valves or suction-valve timing to control amount of discharge and time of injection.

An example of the widely used port-controlled type is the Bosch pump shown below (13). The pump body contains a barrel and a closely fitted plunger carrying a helical recess. Position of this helix in relation to ports in the barrel determines amount of fuel discharged, as will be seen later. Cam action (see 12) lifts the plunger and spring action returns it. A bushing encloses the pump barrel, carrying a pinion which engages a rack actuated by the governor. A crossarm on the plunger fits slots on opposite sides of the bushing's lower section. With this arrangement, governor action produces necessary changes in angular position of the plunger without interfering with its reciprocating action.

The pump operates as follows: A fuel transfer pump keeps the injection-pump suction line filled with oil under slight pressure so that ports are always submerged. From

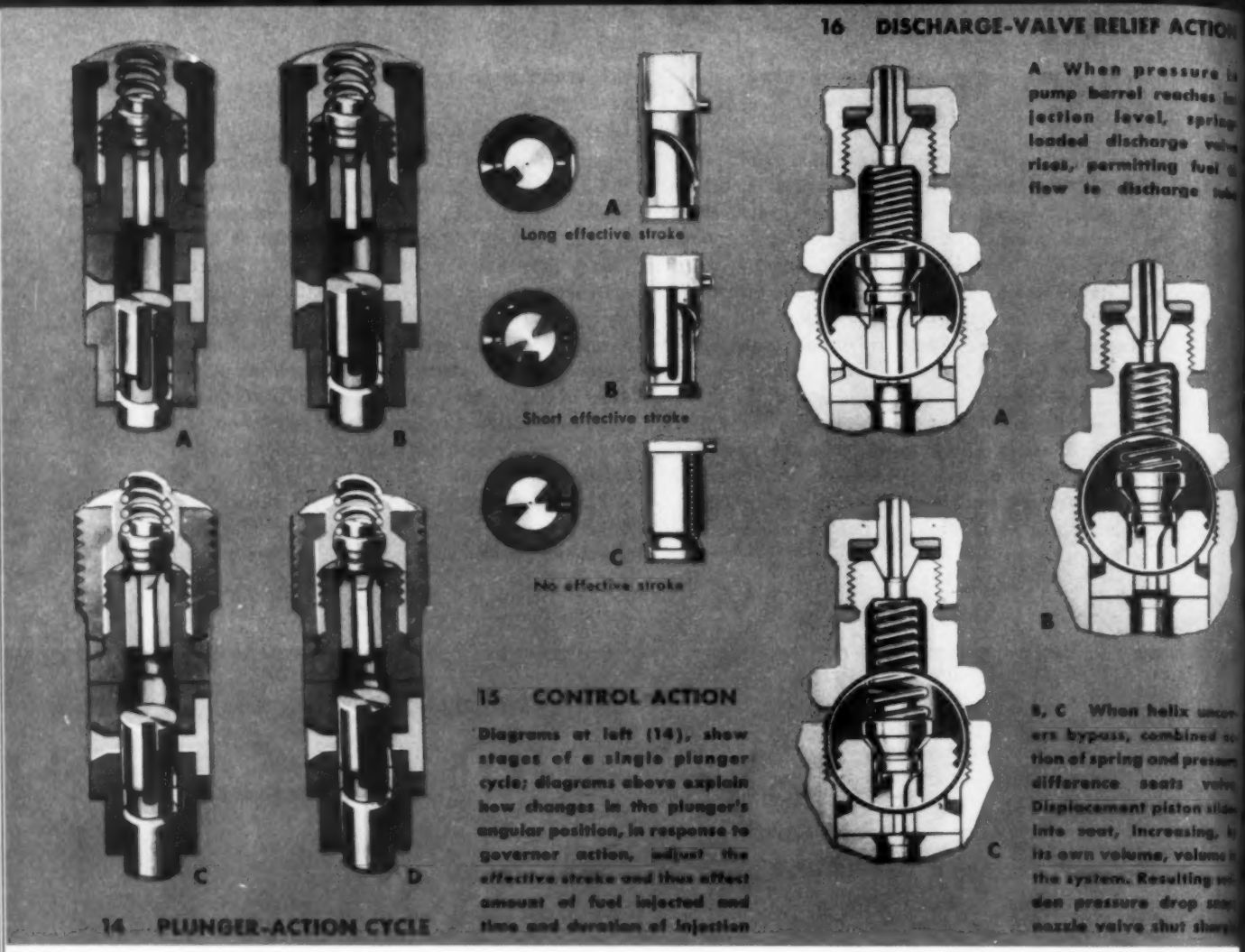


12 TYPICAL PUMP-INJECTION-SYSTEM HOOKUP

An individual port-controlled pump, cam driven, meters and times injection, discharging directly into high-pressure tubing leading to fuel nozzle, which contains an hydraulically actuated needle valve

13 SINGLE PORT-CONTROLLED PUMP

Cam-operated plunger makes constant strokes; helix on plunger opens bypass port to control fuel quantity. Spring-loaded discharge valve opens at injection pressure; closes when helix opens bypass


16 DISCHARGE-VALVE RELIEF ACTION
A When pressure in pump barrel reaches injection level, spring-loaded discharge valve rises, permitting fuel to flow to discharge tube
A
B
C
D
A
Long effective stroke
B
Short effective stroke
C
No effective stroke
14 PLUNGER-ACTION CYCLE
15 CONTROL ACTION
Diagrams at left (14), show stages of a single plunger cycle; diagrams above explain how changes in the plunger's angular position, in response to governor action, adjust the effective stroke and thus effect amount of fuel injected and time and duration of injection
A
B
C
B, C When helix uncovers bypass, combined action of spring and pressure difference seats valve. Displacement piston slides into seat, increasing, by its own volume, volume of the system. Resulting sudden pressure drop seats nozzle valve shut sharply

the time the top edge of the plunger uncovers the ports on the downstroke until it closes them on the upstroke, fuel enters and fills the space above the plunger and flows through the vertical groove to fill the helical recess in the plunger.

As the plunger travels upward it closes the ports and the oil above the plunger, and in the groove and recess, is trapped, because neither groove nor recess registers with any port (see diagrams of plunger action, 14 above). Pressure builds up in the pump, the spring-loaded discharge valve opens and fuel flows through the tubing to the nozzle. When pressure at the nozzle reaches desired injection level, its spring-loaded needle valve opens and injection starts. It continues until the plunger has risen enough to cause the helical upper edge of the recess to pass the port, which releases pressure through the groove and bypass port. Both nozzle needle valve and pump discharge valve close and the cycle repeats.

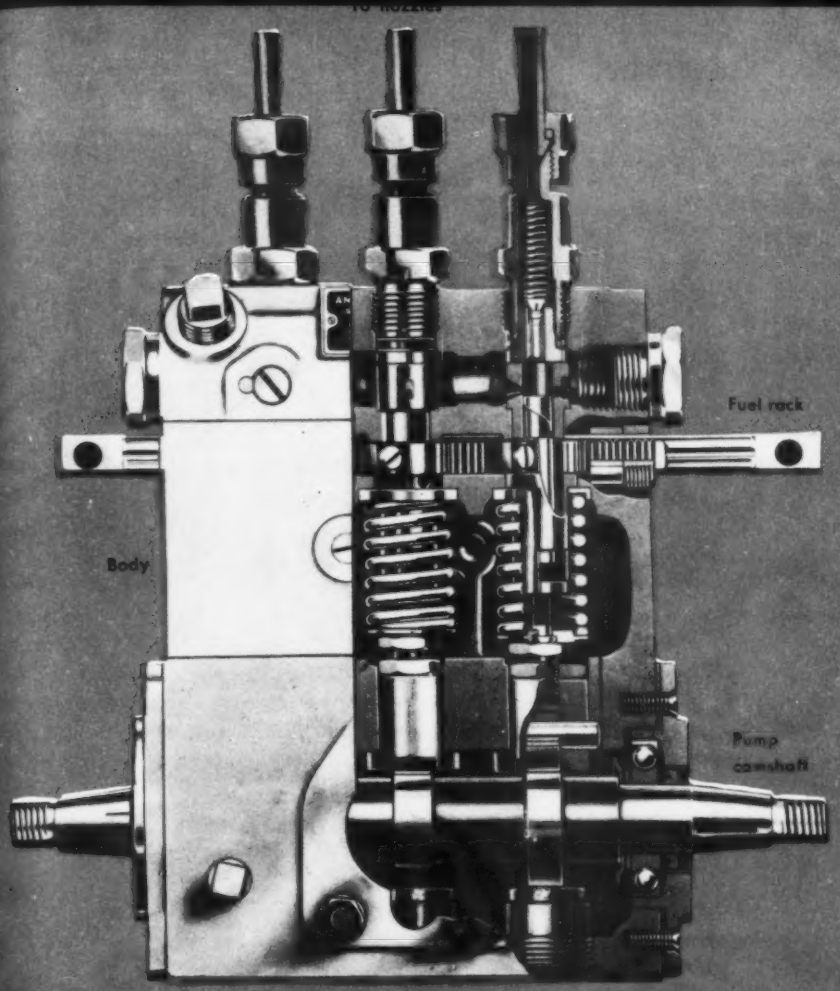
It can be seen that amount of fuel injected depends on how long it takes for the helix to uncover the port. This, in turn, depends on the plunger's angular position, which is controlled by the fuel rack and governor. The diagrams above show this control action clearly.

At full load the plunger takes a position with the vertical groove close to the suction port. The pump begins to build pressure when the top of the plunger closes the ports on the upstroke and discharge continues until the upper helical edge of the recess passes the bypass port. With the plunger in the full-load position, the lower end of the helix registers with the port and thus the effective stroke is long, as shown in 15-A.

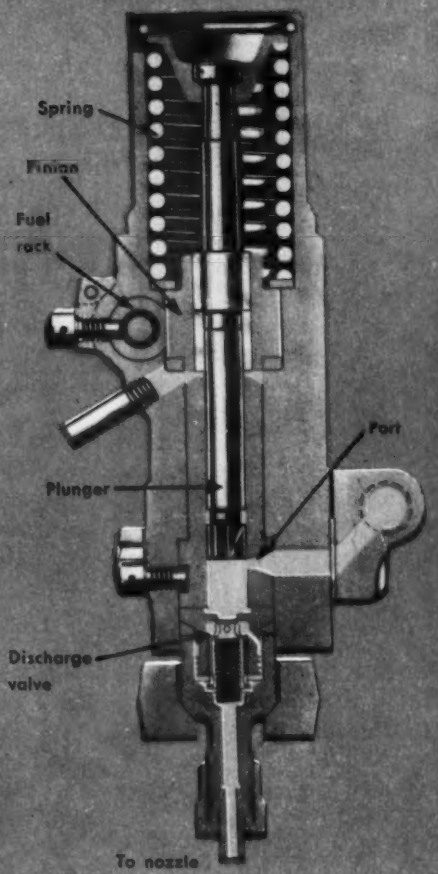
When load decreases, the governor moves the fuel rack and changes the angular position of the plunger so that the vertical groove moves toward the bypass port, as in 15-B. This causes the helical edge to pass the port sooner on the upstroke, thus releasing pressure earlier and shortening duration and amount of injection. The phantom plunger in the diagram shows the reduction in effective stroke clearly.

If the plunger is turned to the position shown in 15-C, with the vertical groove registered with the bypass port, the pump builds no pressure because there is always a connection between the space above the plunger and the bypass port. This is the "stop" position.

The spring-loaded discharge valve previously mentioned opens when pressure in the pump barrel rises, taking the position shown in 16-A. This permits fuel to flow through discharge tubing to the fuel nozzle and the engine cylinder. As soon as the plunger's helical edge uncovers the bypass port, combined action of the spring and the great pressure difference between pump barrel and discharge tubing returns the valve to its seat. In closing, the delivery valve performs two functions: It prevents excessive draining of fuel from the discharge tubing during bypassing and the



17 MULTIPLE-CYLINDER PORT-CONTROLLED PUMP



18 PUMP WITH ONE PORT

In this design, a single port serves for both inlet and bypass; camshaft runs overhead; pump discharges downward

plunger's suction stroke, and it relieves pressure in the discharge tubing.

Pressure relief results from action of a displacement piston on the delivery valve, below its conical seat and above its flutes. Before the delivery valve actually seats, after the plunger helix has uncovered the bypass port, the piston slides down into the delivery-valve seat as shown in 16-B and 16-C. By sliding down into the valve seat with a plunger-like action, the piston increases, by its own volume, the volume in the system from the delivery valve to the nozzle valve. The resulting sudden pressure drop snaps the nozzle valve shut, cutting off fuel injection sharply and eliminating dribbling.

Constant-stroke port-controlled pumps are built by a number of other manufacturers of injection equipment and by several engine builders. The port-controlled pumps built by Aircraft & Diesel Equipment Corp employ an helically grooved plunger similar to that shown in 14. Design of the control rack, pinion, bushing and connection to the plunger differs. The discharge valve is hollow, with ports below the conical seat.

Similar plunger design marks the Diesel Engineering & Mfg Corp pump, but in this case intake and bypass ports are segregated to eliminate any hydraulic interference. Fuel enters an intake port in the outer casing, flowing into a suction chamber and thence into the barrel through the inlet port. When the upper edge of the helix opens the bypass port, oil flows out into a spill chamber which connects to the suction chamber.

Plunger and port design in Bendix-Scintilla pumps differs from any of those described. Inlet and bypass ports are on the same side of the pump barrel and the supply chamber in the pump housing is divided into two grooves opposite inlet and bypass ports. A vertical hole in the center of the plunger leads from the pumping chamber to a crossbore running between the metering helix on one side and a lubricating slot on the other. The metering helix is a groove or slot, with both edges helical, instead of a recess with only the top edge helical.

Port-controlled injection pumps built by Caterpillar Tractor Co and Fairbanks, Morse & Co for their own engines, use only one port, which serves as an inlet and for bypass or pressure relief as well. The FM pump shown in 18, for their opposed-piston engine, mounts in the position shown. The camshaft runs overhead and the pump discharges downward, the tubing running but a short distance to the nozzle located at one side of the central combustion chamber. Another nozzle injects from the opposite side of the cylinder.

Port-controlled pumps are built both as individual units, like those pictured thus far, and as multi-cylinder combinations like 17. Individual units may be mounted separately, usually at or near cylinder center-lines, with separate suction connections, or they may be grouped

and submerged in an auxiliary fuel reservoir, served by a single fuel suction line. The multi-cylinder pumps contain an integral camshaft which is usually driven from the engine camshaft.

At injection pressures (1500 to 8000 psi) oil compresses to some extent and thus control of injection depends on the characteristics of the hydraulic circuit from the plunger to the nozzle tip. It therefore becomes desirable to keep the hydraulic circuits identical if possible, to avoid differences in quantity and timing among the various cylinders. For this reason, individual pumps, located to permit short discharge lines of even length, are usually found on large engines.

In contrast to the port-controlled pumps just described, a number of pumps operating on the constant-stroke principle use valve timing to control fuel quantity. The Ex-Cell-O pump below (19), works in this fashion.

Individual pump cylinders stand radially around a central rotary valve. The drive unit has a vertical takeoff for governor drive and powers a wobble plate which gives reciprocating motion to injection-pump-plunger pushrods. The central valve turns at wobble-plate speed.

After passing through strainer, transfer pump and filter, fuel flows to a recess formed by a spool-like reduction in diameter of the rotary valve. Valve ends fit closely in the bore, preventing any escape of fuel endwise. The middle spool-like section of the valve has one triangular section or *land,* which has same diameter as spool ends and forms, therefore, a close pressure-tight fit.

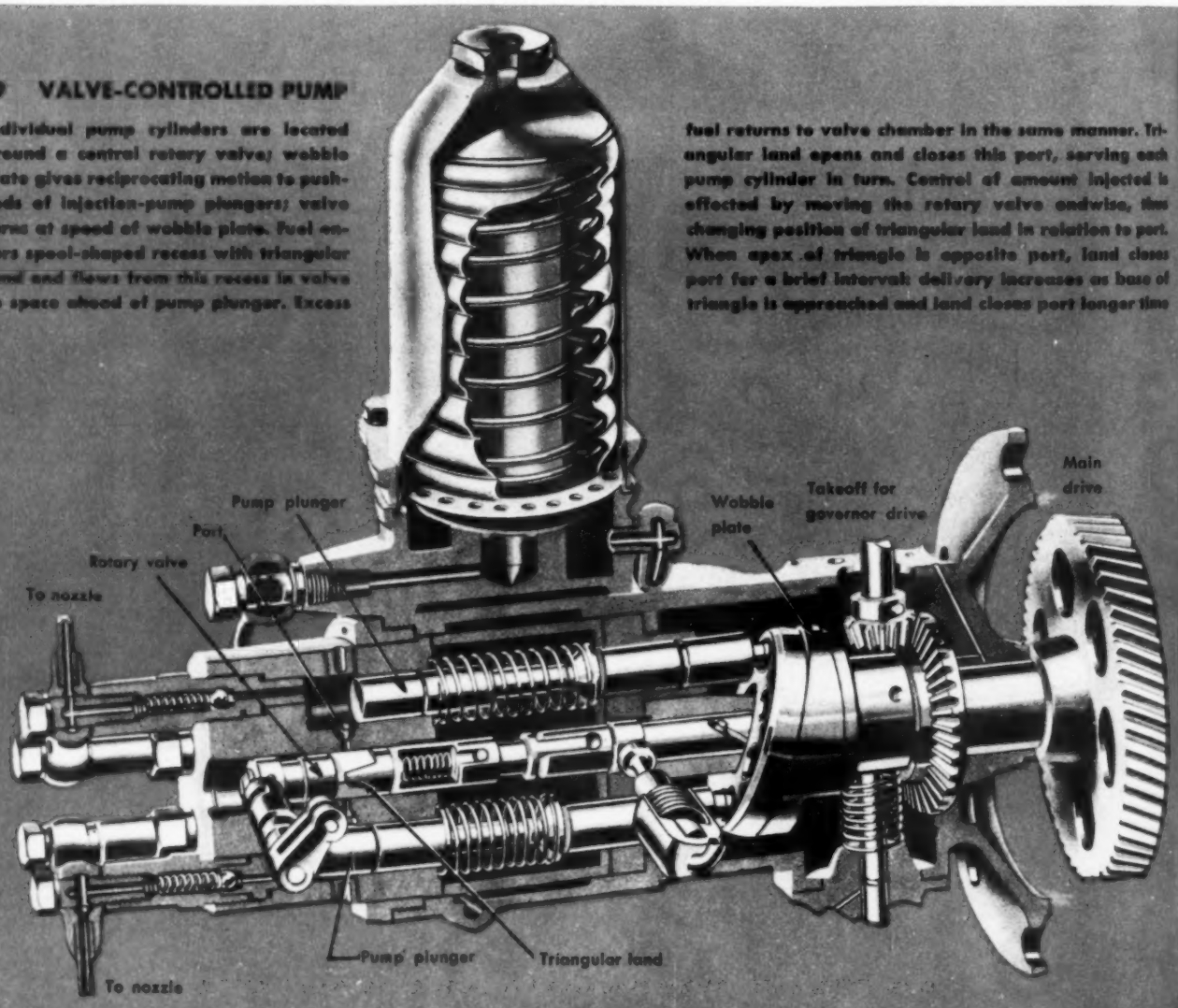
Fuel flows from the valve recess to the space ahead of the injection-pump plunger, by way of a port, and excess fuel returns to the valve chamber in the same way. The triangular land on the rotary valve opens and closes this port. Valve and plunger action shows clearly in the sequence diagrams on the facing page, (20).

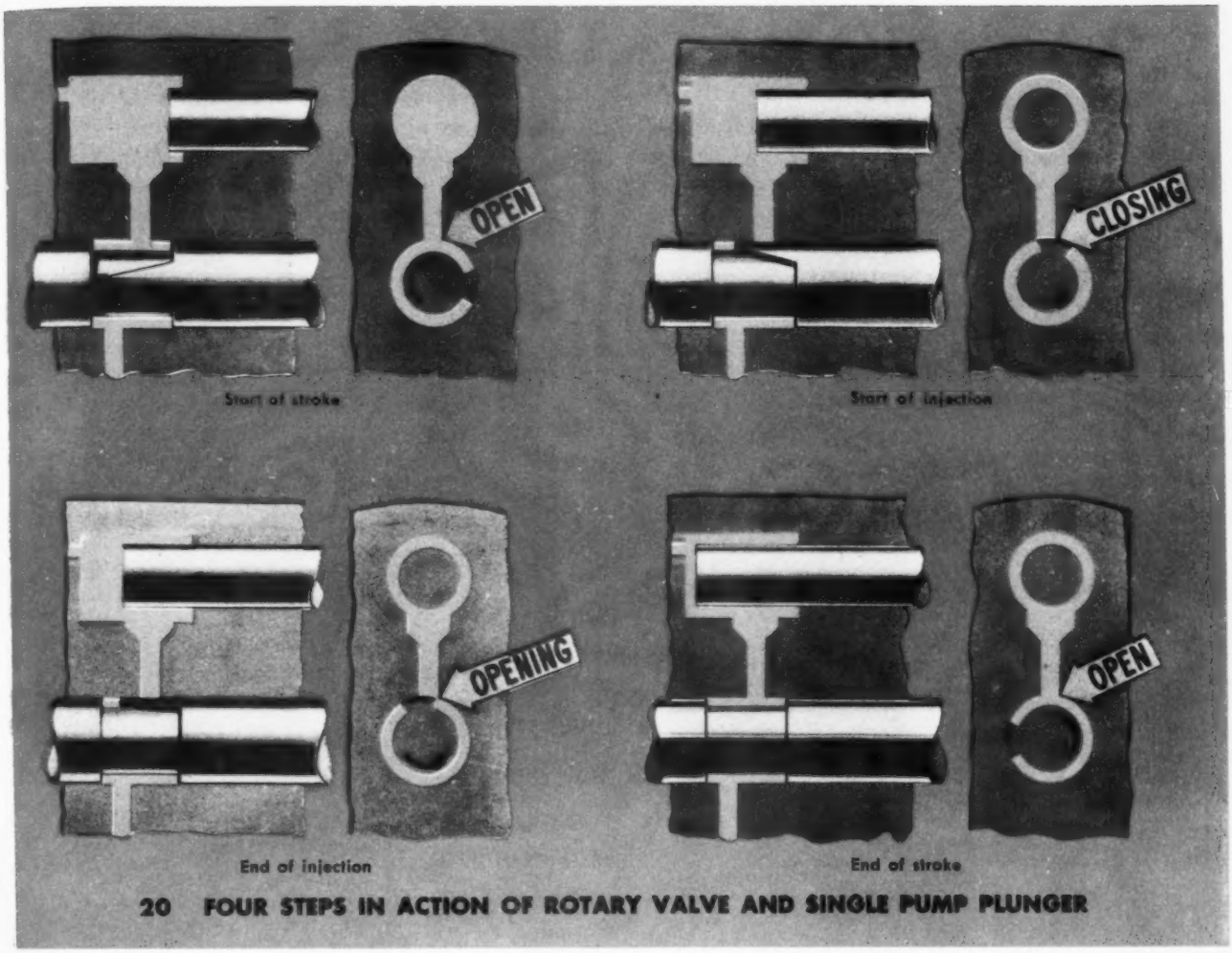
Starting with the filling stroke, it can be seen that the port leading to the space ahead of the plunger is open and the fuel flows in to fill the space. As the plunger moves in the discharge direction, the valve rotates to a position where the triangular land starts to close the port. Plunger motion then builds up pressure until the delivery valve at the end of the plunger space opens and fuel flows into the discharge tubing. Continued valve rotation puts the triangular land past the port opening, relieving pressure in the plunger chamber. Excess fuel returns to the valve chamber through the port.

Control of amount of fuel injected is effected by moving the rotary valve endwise, thus changing position of the triangular land in relation to the port. When the apex of the triangle is opposite the port, the land closes the port for a brief interval only and fuel delivery is short; when the base of the triangle comes opposite the port, the greater width of the land closes the port for a much longer time and delivery is increased proportionately.

19 VALVE-CONTROLLED PUMP

Individual pump cylinders are located around a central rotary valve; wobble plate gives reciprocating motion to pushrods of injection-pump plungers; valve turns at speed of wobble plate. Fuel enters spool-shaped recess with triangular land and flows from this recess in valve to space ahead of pump plunger. Excess fuel returns to valve chamber in the same manner. Triangular land opens and closes this port, serving each pump cylinder in turn. Control of amount injected is effected by moving the rotary valve endwise, thus changing position of triangular land in relation to port. When apex of triangle is opposite port, land closes port for a brief interval; delivery increases as base of triangle is approached and land closes port longer time





20 FOUR STEPS IN ACTION OF ROTARY VALVE AND SINGLE PUMP PLUNGER

Operating from the main drive unit, the rotary valve turns at the same speed, while the wobble-plate action is such that individual injection plungers stand at different stroke positions at any one time, and therefore in different relations to the rotary valve. Wobble-plate action, and its timing with the rotation of the valve, permits the single valve to serve each injector in turn.

Advance of injection timing can be accomplished by advancing the phase relation of the central valve with respect to the timing of the pump drive shaft.

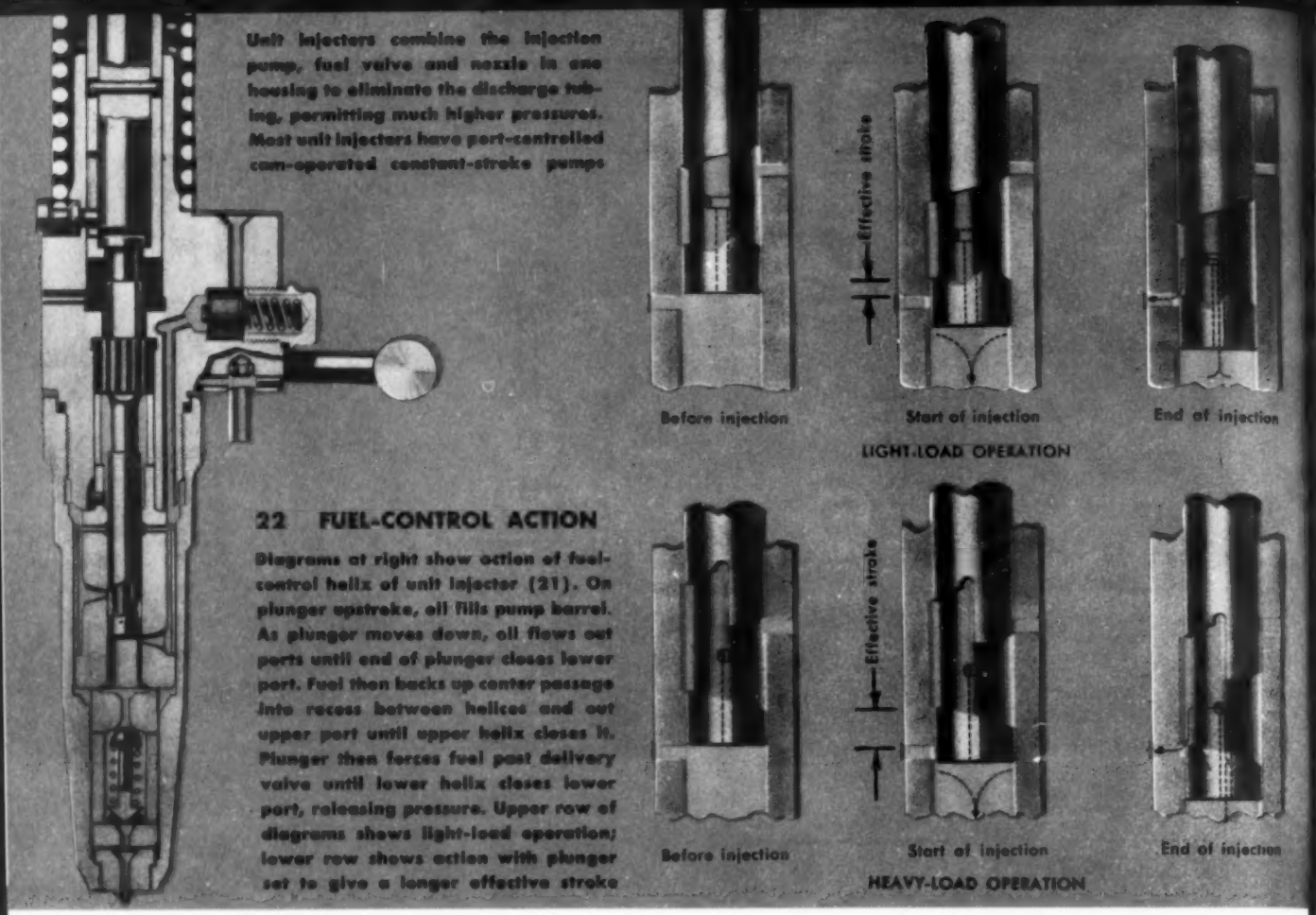
The valve-controlled constant-stroke principle appears also in the individual units built by Aircraft and Diesel Equipment Corp., and in pumps used by several engine builders. In the Adeco pump, there is a cam-operated constant-stroke plunger and a bypass or "spill" valve actuated by a rocker from the plunger assembly. Fuel enters a suction chamber and flows through a suction valve into the pump barrel on the plunger downstroke. On the upstroke, pressure lifts the discharge valve and fuel flows into the discharge tubing, until the spill valve opens to bypass fuel back to the suction chamber and thus to release pressure and permit the discharge valve to close.

The rocker and tappet assembly for the spill valve is so arranged that the control rod changes the clearance between the tappet and the valve stem. When the control is at full load, the clearance is great and the plunger moves a considerable distance before the rocker opens the spill valve; at partial loads the clearance becomes less and effective stroke decreases.

Several engine builders use the timing of a suction valve to regulate quantity of fuel injected; pumps of this design appear on Alco-Sulzer and Fairbanks, Morse units, for example. In a typical pump of this design, the plunger makes a constant stroke, driven from a fixed cam. The shaft carrying the plunger cam also carries a suction-valve cam whose position in relation to the plunger cam can be altered by the governor. As the plunger descends, fuel flows in through the suction valve, which is held open by the governor-controlled cam. On the upstroke, oil flows out the suction valve until its cam permits it to close. Pressure above the plunger then rises and the discharge valve opens. To insure that oil will not dribble after the delivery stroke ends, the plunger strikes a relief valve which allows fuel to bypass; quick pressure drop snaps the nozzle valve shut.

It can be seen that in this pump design, quantity of fuel injected depends on timing of suction-valve closing which, in turn, depends on the position of the valve cam in relation to the fixed plunger cam.

Thus far all pumps pictured and discussed have operated with a constant stroke. Changes in pump discharge required to meet variations in load and thus in fuel needed can also be produced by altering length of pump stroke. In Kahlenberg engines, for example, individual fuel pumps cluster around a single cam drive. By extending or with-


Unit injectors combine the injection pump, fuel valve and nozzle in one housing to eliminate the discharge tubing, permitting much higher pressures. Most unit injectors have port-controlled cam-operated constant-stroke pumps
Effective stroke
Before injection
Start of injection
End of injection
LIGHT-LOAD OPERATION
Effective stroke
Before injection
Start of injection
End of injection
HEAVY-LOAD OPERATION

22 FUEL-CONTROL ACTION

Diagrams at right show action of fuel-control helix of unit injector (21). On plunger upstroke, oil fills pump barrel. As plunger moves down, oil flows out ports until end of plunger closes lower port. Fuel then backs up center passage into recess between helices and out upper port until upper helix closes it. Plunger then forces fuel past delivery valve until lower helix closes lower port, releasing pressure. Upper row of diagrams shows light-load operation; lower row shows action with plunger set to give a longer effective stroke

drawing the single cam used to drive the fuel pumps, the governor changes the pump stroke and amount of fuel delivered. In addition, the fuel cam can be moved to change the timing of injection.

The small diesels manufactured by R H Sheppard also employ injection pumps working on the variable-stroke principle. The individual pump cylinders mount above a camshaft that is really a shaft within a shaft; the center being movable longitudinally. This motion retracts or protrudes the cams to change pump stroke as needed.

Unit injectors, a relatively recent development, combine the pump, fuel valve and nozzle in a single housing to eliminate the discharge tubing. This permits extremely high injection pressures — up to 20,000 psi in the case of one unit-injector design.

The General Motors unit injector is shown in 21, above. These units are located in the cylinder head and are actuated through pushrods and rockers from the camshaft. Fuel reaches the injector under slight pressure and enters through a filter element in the inlet passage. It then flows down into an annular supply chamber between the bushing which forms the pump barrel, and the outer casing. The plunger moves up and down in this bushing, the bore of which connects to the annular chamber by two ports, one on each side at different heights.

The upper end of the plunger fits into a spring-loaded follower piston. The rocker arm bears against the follower, forcing the plunger down, and the spring returns it. The plunger remains free to turn, and it carries a pinion engaging a governor-actuated fuel rack. The diagrams in 22, above, show how the recesses cut in the plunger regulate fuel quantity and injection timing.

On the upstroke, oil flows from the annular space into the pump barrel, filling it. As the plunger moves down, oil is forced out the ports until the lower end of the plunger cuts off the lower port. Fuel then backs up through the center passage into the recess between the helices. From this recess, oil can still flow back to the annular chamber until the upper helix closes the upper port.

After ports close, plunger downstroke forces fuel past the delivery valve and out through the spray-tip orifices. Fuel delivery continues until the lower helix clears the lower port, which permits oil to flow through the central passage into the helical recess and out the lower port.

For full-load operation the plunger moves so that both upper and lower ports close simultaneously, producing a full effective stroke and maximum injection. If the control rack moves to the extreme opposite position, the upper port is not closed by the upper helix until after the lower helix has uncovered the lower port. In this case, all fuel flows back into the supply chamber and no injection occurs.

The unit injector used in Murphy diesels also operates on the port-controlled constant-stroke principle but differs considerably in construction. For example, the heavy spring forces the plunger down; the cams lift the plunger, compressing the spring for the return stroke. Thus, should a dirt particle get past the several filters, including one in the upper part of the annular space, no breakage will result because the only force acting on the plunger is the spring pressure, which is held to a safe value.

FUEL VALVES AND NOZZLES

Variously referred to as either valve or nozzle, this part of the injection system usually performs both functions. It opens and closes the passage to the cylinder space and it converts the high-pressure oil into a spray of desired pattern and penetrating power.

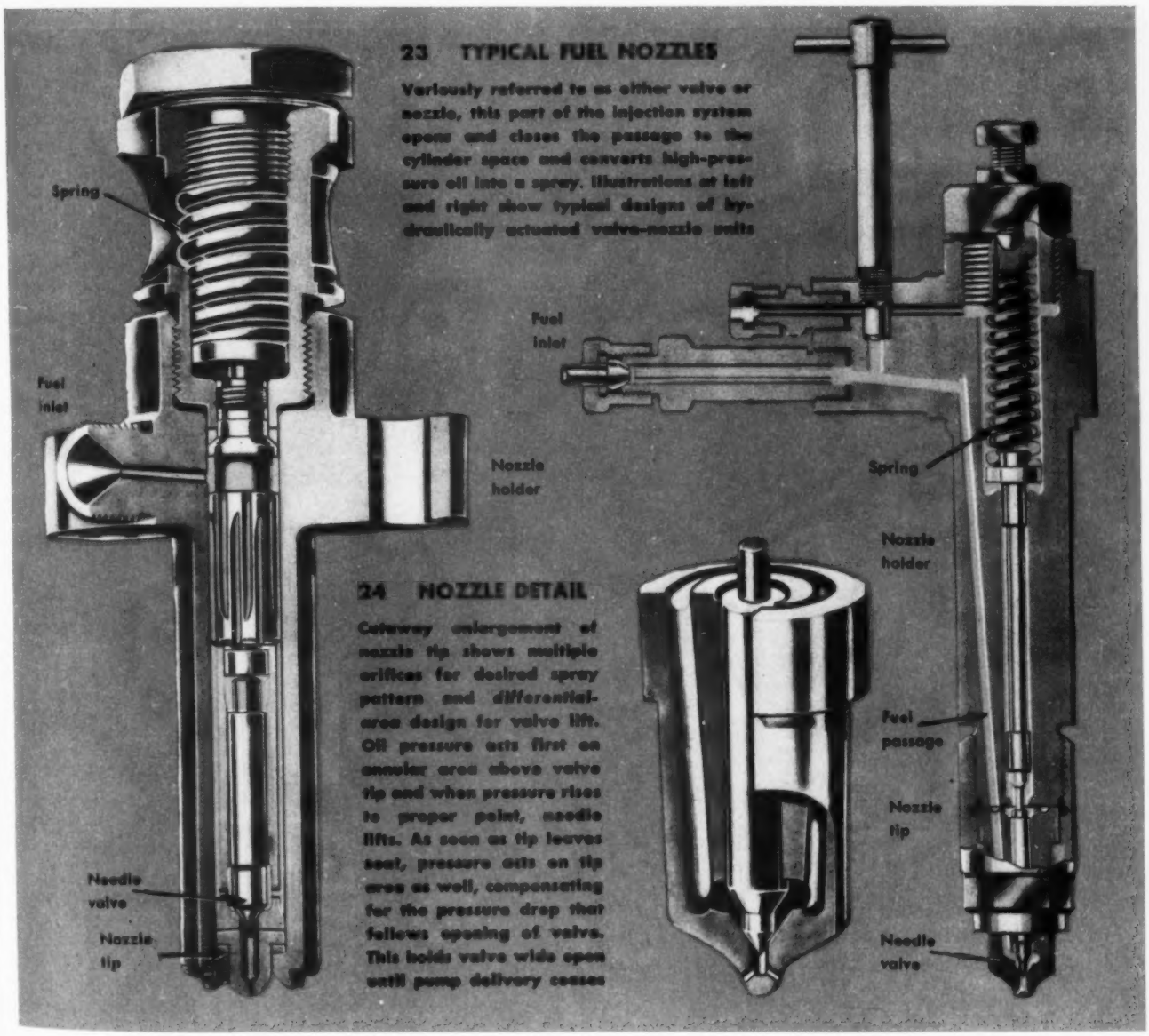
For the typical common-rail injection system, under substantially constant pressure, a mechanically operated valve is needed. Such valves are discussed on page 81. In pump-injection systems, the pressure rise created by the plunger's discharge stroke can be made to actuate the valve hydraulically.

Such valves are usually of the *differential-area* type. This design is necessitated by the fact that if the valve opens when pressure in the discharge tubing reaches a certain point, opening of the valve and beginning of flow will cause a drop in pressure. Unless some special arrangement is made, the valve will close when pressure drops. The differential action illustrated in drawings 23 and 24, below, solves this problem in a simple and ingenious fashion.

In these valves, oil pressure acts first on the annular area (see detail in 24) and when pressure rises to the proper point, the needle lifts. As soon as the valve tip leaves its seat the pressure begins to act on the valve tip as well. The result is a substantial increase in area to compensate for the drop in pressure following opening of the valve. This holds the needle valve wide open until pump delivery ceases, when the valve snaps shut. Construction differs in the Fairbanks, Morse (left) and Bosch valves (right), but the principle is the same.

Most fuel valves consist of two parts, a nozzle holder or body, which contains the mechanism, and a nozzle tip, which forms the spray. The valves illustrated show ways of combining these elements. The holder usually fastens to the cylinder head by a yoke and studs.

Nozzle-tip design depends largely on the shape of spray pattern required by a particular engine's combustion



23 TYPICAL FUEL NOZZLES

Variously referred to as either valve or nozzle, this part of the injection system opens and closes the passage to the cylinder space and converts high-pressure oil into a spray. Illustrations at left and right show typical designs of hydraulically actuated valve-nozzle units

24 NOZZLE DETAIL

Cutaway enlargement of nozzle tip shows multiple orifices for desired spray pattern and *differential-area* design for valve lift. Oil pressure acts first on annular area above valve tip and when pressure rises to proper point, needle lifts. As soon as tip leaves seat, pressure acts on tip area as well, compensating for the pressure drop that follows opening of valve. This holds valve wide open until pump delivery ceases

chamber. Common nozzle types are *single-* or *multiple-hole* and *pintle* or *throttling*.

Axis of a single hole may be the same as that of the nozzle or at an angle to it; the jet produced is conical, having an angle of about 4 to 15 deg. At an angle greater than 12 deg. any slight inaccuracy in manufacture may disturb the uniformity of the jet cone; the wider the angle the more likely that a major part of the fuel will be injected unevenly. Wider spray angles are sometimes obtained by use of spiral grooves which impart a centrifugal motion to fuel drops.

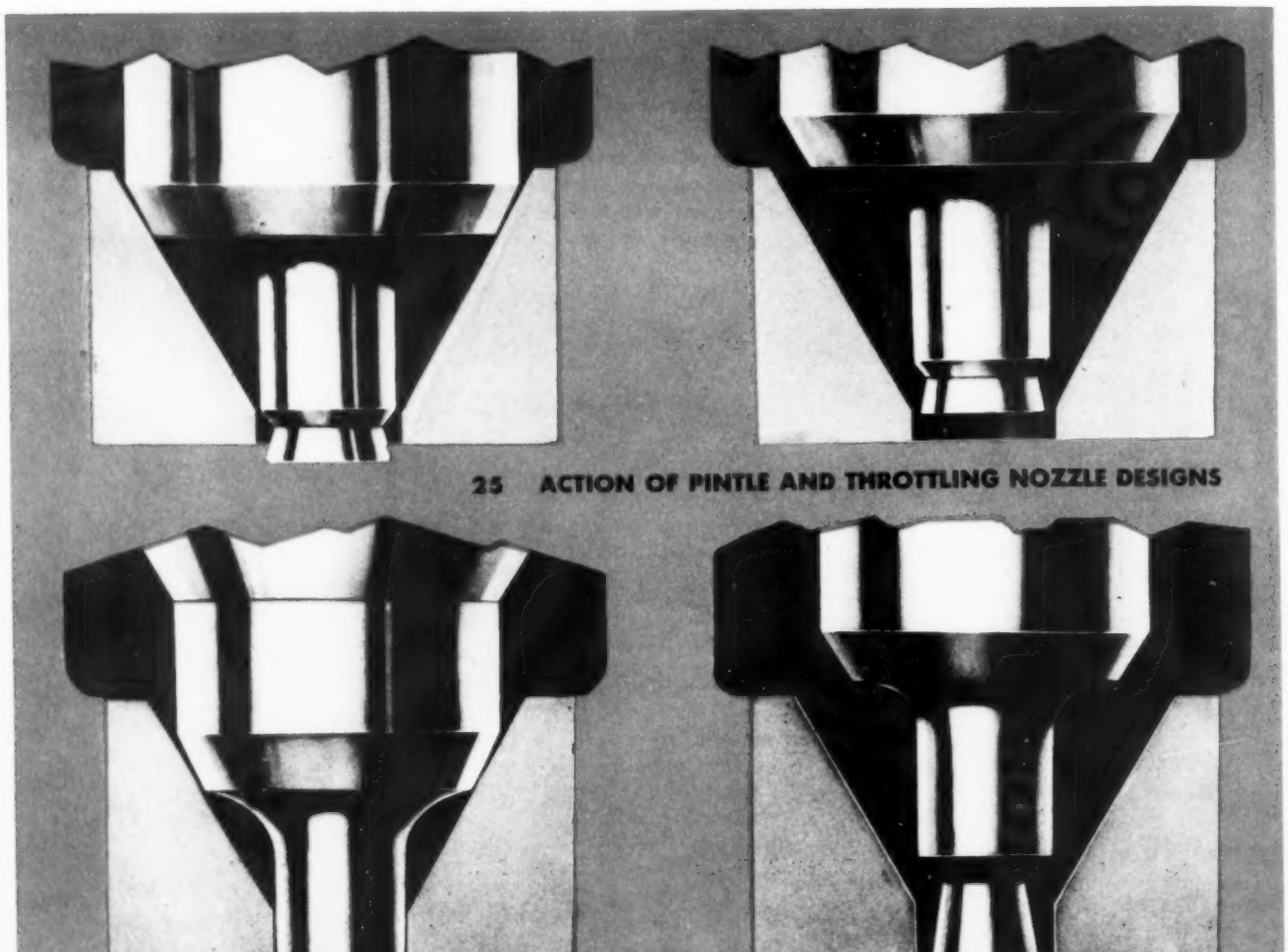
Single-hole nozzles offer the advantage of a fairly large opening even in small high-speed engines, which usually means less operating trouble. They are used in engines where combustion-chamber shape creates turbulence and there is thus no need for a finely atomized and deeply penetrating spray.

Multiple-hole nozzles find most use in open combustion chambers, where it is necessary to distribute the fuel spray to all parts of a wide, shallow chamber. Of course, the more spray openings, the smaller each becomes and the more necessary it is that fuel be clean.

Pintle nozzles are fitted with valves whose ends carry a shank or pin, as in 25, the shape of which is made according to the spray pattern and injection characteristics desired. The pintle reaches into the nozzle orifice to form an annular space. By suitably shaping the pin the designer obtains either a hollow cylindrical jet of high penetrating power or a tapered spray with an angle up to about 60 deg. In general, the wider the angle the better the atomization but the poorer the penetration.

This arrangement permits fine variations in spray characteristics; for instance, the cross-section of the orifice can be opened gradually during the lifting of the valve stem if the pin is tapered. Or, if the pin consists of two cylindrical sections, the orifice can be opened in steps. In this way only a small quantity of fuel is injected first, followed by the main charge. This prevents a sudden rise in cylinder pressure and gives smoothness to engine operation.

The double throttling effect of the nozzle, first at the valve seat, and then at the nozzle orifice, is responsible for the fact that the pintle type works very uniformly and accurately. In addition, the motion of the pin tends to prevent formation of a carbon crust.



25 ACTION OF PINTLE AND THROTTLING NOZZLE DESIGNS

Nozzles carrying a shank or pin which reaches into orifice to form an annular space are called *pintle* or *throttling* nozzles (above and below, respectively). This design permits fine variations in spray characteristics and close control

Automatic Industrial Load Control Increases Power-Service Reliability

When a large industrial plant needed more power quickly it tied in with the local utility system and installed automatic load control to keep power interruption to a minimum by isolating the systems in the event of outside trouble

By CARL LAU*
AND
C B PADON**

▶ EARLY IN 1942 the Nordberg Mfg Co. of Milwaukee, Wis., had practically to triple its power supply. This change had to be made in short time even though the existing powerhouse had no space for additional equipment.

Up to about 15 years ago all power generated in the plant was dc, approximately 1000 kw of steam-driven units. Later a 750-kva 480-v 3-phase 60-cycle steam-engine-driven generator was added. To utilize excess dc-generator capacity at certain periods of the year, a 250-v dc to 480-v ac 700-kva motor-generator set was installed. Later, the dc load increased to where the motor-generator had to operate a large part of the time to convert ac to dc, and further decreased the ac supply for plant load.

Power Plant Expansion

In 1940, power for plant lighting took a big jump when illumination intensity was increased to an average of about 50 foot-candles. This required installing a 750-kva diesel-driven 480-v generator and a 750-kva 480- to 208- and 120-v lighting transformer. Ac generating capacity was now 1500 kva and was available when war expansion was authorized in 1942, which required 2500 kva additional capacity. Additional generating units could not be installed because the present power plant did not have space. Space was not available on company property to build another power plant, and generating units, either diesel or steam, could not be obtained in time for the power needs. Although studies clearly indicated the economy and desirability of diesel-electric power-generating equipment, the manufacturing plant's entire diesel and steam-engine building facilities were required to meet production schedules for the armed services. Thus, arrangements were made

(*Continued on page* 98)

* Electrical superintendent, Nordberg Mfg Co
** District engineer, Westinghouse Elec & Mfg Co

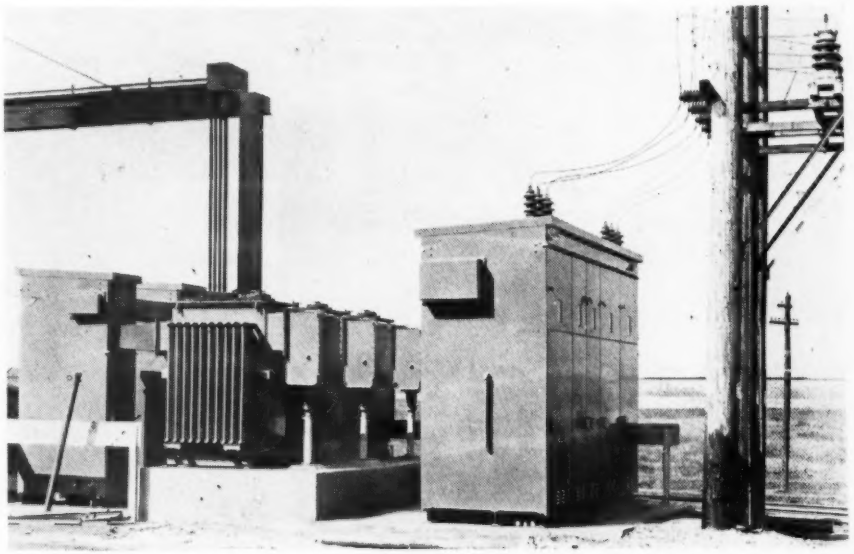


Fig. 1—West substation with 4-section 13.2-kv outdoor switch house for power-company lines on right and three 600-kva 13.2-kv to 480-v unit-substations on left

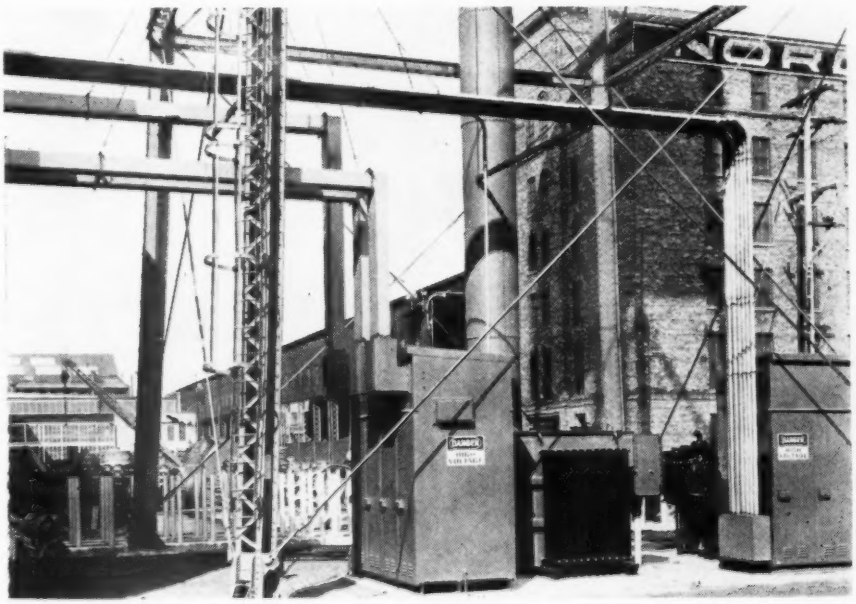
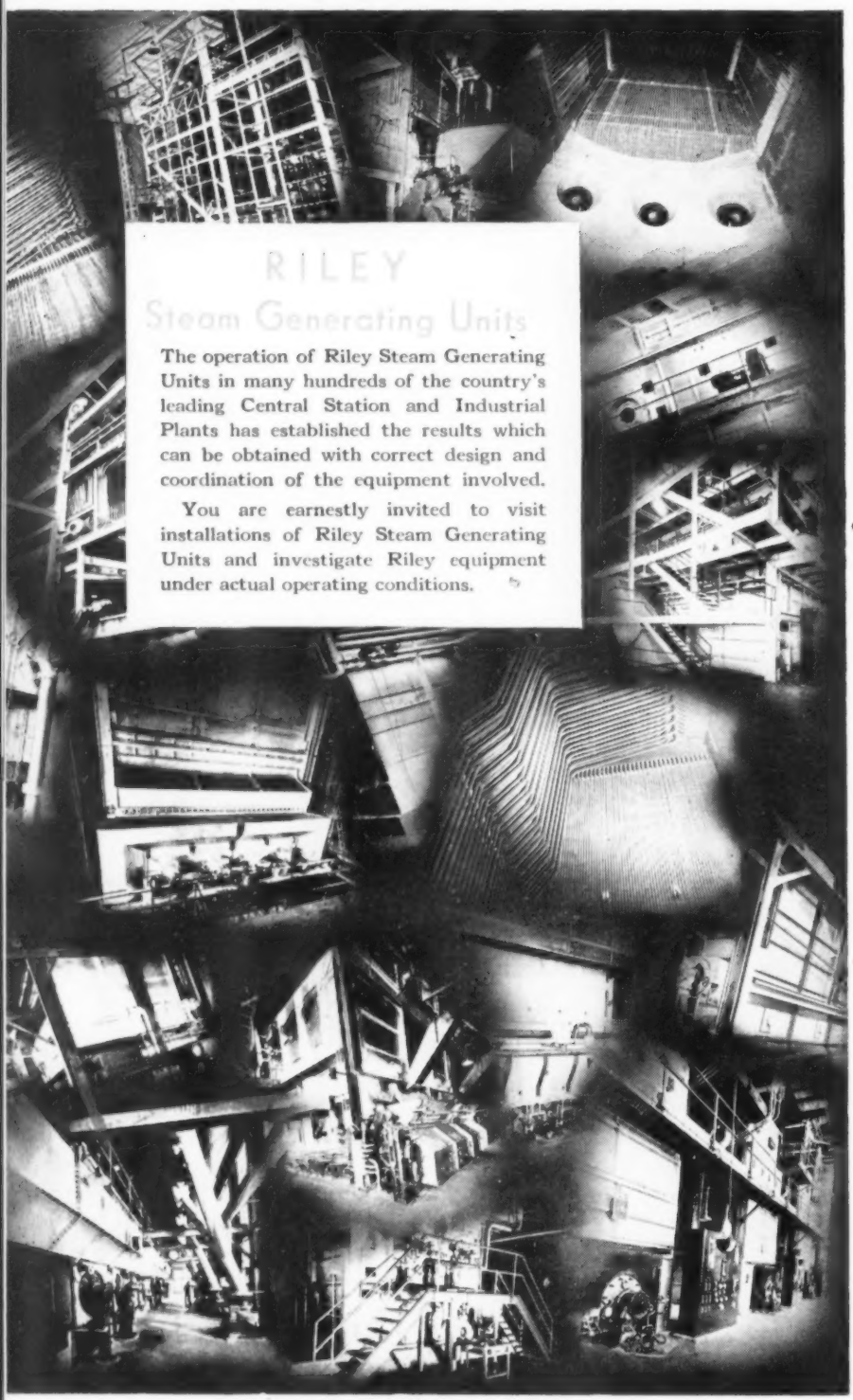


Fig. 2—East substation includes one 750-kva 13.2-kv to 480-v unit-substation for power, and one 300-kva 13.2-kv to 208- and 120-v unit-substation for lighting

You will get what you want in



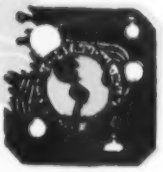
RILEY
Steam Generating Units

The operation of Riley Steam Generating Units in many hundreds of the country's leading Central Station and Industrial Plants has established the results which can be obtained with correct design and coordination of the equipment involved.

You are earnestly invited to visit installations of Riley Steam Generating Units and investigate Riley equipment under actual operating conditions.

These well-known companies have placed from one to nine repeat orders for Riley Boilers:

Carnegie Illinois Steel Corp.
Curtiss-Wright Corp.
Dow Magnesium Co.
Carbide & Carbon Chem. Corp.
General Electric Co.
Standard Oil Co. of N. J.
Standard Oil Co. of Calif.
Celanese Corp. of America
Allis Chalmers Mfg. Co.
Norton Company
American Brass Co.
Winchester Repeating Arms Co.
A. O. Smith Corp.
The Bullard Company
American Viscose Corp.
Union Electric Co.
Commonwealth & Southern Corp.
Humble Oil & Refining Co.
Western Cartridge Co.
Pet Milk Company
Revere Copper & Brass Co.
General Motors Corp.
Masonite Corp.
Houston Lighting & Power Co.
Otter Tail Power Co.
Swift & Company
Publicker Comm. Alcohol Co.
General Aniline Works
Crown Cork & Seal Co.
U.S. Gypsum Co.
Container Corp. of Americ
Modine Mfg. Co.
Beechnut Packing Co.
Mead Corporation
Ohio Salt Company
Nevada Consolidated Copper Co.
Heyden Chemical Corp.
Republic Creosoting Co.
Isaacson Iron Works
Great Western Sugar Co.
Waterbury Button Co.
Savannah Sugar Refining Co.
W. Va. Pulp & Paper Co.
J. S. Abercrombie Co.
Central Ohio Lt. & Pwr. Co.
Univ. of Minnesota
St. Croix Paper Co.
Dakota Public Service Co.
Franklin Heating Station
Frankfort Arsenal



RILEY

STOKER CORPORATION, WORCESTER, MASS.

Boston New York Philadelphia Baltimore Buffalo Cleveland Detroit Chicago St. Louis Cincinnati
St. Paul Kansas City Denver Seattle Portland Los Angeles Houston New Orleans Atlanta Memphis

It will pay you to visit modern Riley Installations

a boiler unit, with Riley Units

Purchasers of steam generating units are primarily interested in obtaining equipment which will produce the desired quantities of clean dry steam at lowest overall costs with continuity of trouble-free operation. A thorough investigation by you of existing Riley installations will convince you that Riley Units meet these requirements admirably.

A few reasons for Outstanding Performance of Riley Steam Generating Units

CLEAN DRY STEAM

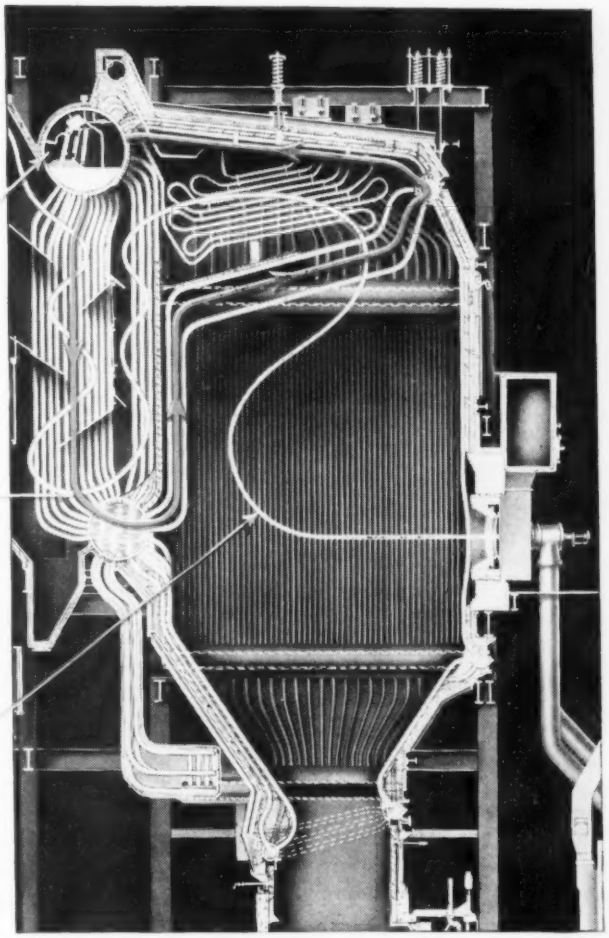
With Riley Units large steam release drums are used. Steam is released in the large open space of the drum above the water level, assuring quick and complete separation of steam from the water. The Riley steam washer cleans and then dries the steam. Also the design of Riley Units assures a steady water level even with rapid widely fluctuating loads.

RAPID POSITIVE CIRCULATION

Rapid positive circulation is assured with Riley Units because of the ring flow principle of circulation with the use of large areas throughout the circulatory system, eliminating restrictions to circulation; because flow of water and steam is upward in all tubes over which hottest gases pass; and because of the high hydrostatic head resulting from the distance between upper and lower drums.

EFFICIENT GAS FLOW

The distinctive shape of the front tube bank gives a furnace shape which makes each cubic foot of furnace volume effective as well as a long flame travel before passing through the tube banks. Note how the flame doubles back on itself in passing up through the front tube bank. This flame travel assures low carbon losses. Riley Boilers are baffled for cross flow of gases, giving the highest heat transfer.



Typical Riley Pulverized Coal Fired Unit

HIGH OVERALL EFFICIENCY

High overall efficiency results from rapid positive circulation, the arrangement of baffles to give cross flow of combustion gases and to utilize each square foot of heating surface, and from high combustion efficiency resulting from the furnace shape and the elimination of straight-through gas passage through the furnace. Actual results prove that you can definitely rely on Riley Units to exceed guarantees. On twenty-three recent tests actual efficiencies exceeded guarantees by 1.405 points.

CONTINUOUS TROUBLE-FREE OPERATION

Rapid circulation assures proper cooling of boiler heating surface. Adequate furnace volumes and furnace water cooling eliminates slag difficulties. Setting maintenance is negligible as the setting is supported from the structural steel and is protected by water walls. The Riley steel casing assures a permanently air and gas tight closure. These features assure continuous trouble-free operation over long periods of time without forced shutdowns. Many Riley Units are operating for periods well over a year without shutdowns.

A Survey of your power plant by a consulting engineer will possibly show ways of making surprisingly large savings in power costs

COMPLETE STEAM GENERATING UNITS

BOILERS • PULVERIZERS • BURNERS • STOKERS • SUPERHEATERS • FLUE GAS SCRUBBERS
ECONOMIZERS • WATER-COOLED FURNACES • STEEL-CLAD INSULATED SETTINGS • AIR HEATERS

before purchasing Boiler or Fuel Burning Equipment

with the Wisconsin Electric Power Co. to purchase the necessary additional power.

Up to 1942 all power-generation and distribution switching was handled by the switchboard in the powerhouse. About the middle of that year designs were completed and additional outdoor- and indoor-switching facilities and bus-ducts and five outdoor transformer unit-substations (Fig. 1 to 3) were purchased. This equipment went into service early in 1943.

Nordberg and Westinghouse engineers collaborated in the design and application of the new equipment. Installation of modern distribution and lighting units progressed rapidly since they are prefabricated and shipped practically ready for operation.

New equipment included in the west substation a 4-section 13.2-kv outdoor switchhouse for the incoming power-company line, three 600-kva 13.2-kv to 480-v unit-substations, and a 2000-amp outdoor bus-duct tie, which connects to the power-plant 480-v generator bus through tie breaker, No. 5, Fig. 3.

East substation included a 750-kva 13.2-kv to 480-v outdoor unit-substation with three feeders in bus-ducts, a 300-kva 13.2-kv to 208- and 120-v outdoor unit-substation with feeders for lighting, and three 1200-amp 480-v outdoor bus-ducts for power; one duct connects to the powerhouse switchboard through tie breaker No. 16, Fig. 3. The substation located under a water tower, Fig. 2, saves space.

In the powerhouse a centralized control cubicle was installed, in which was

(*Continued on page 148*)

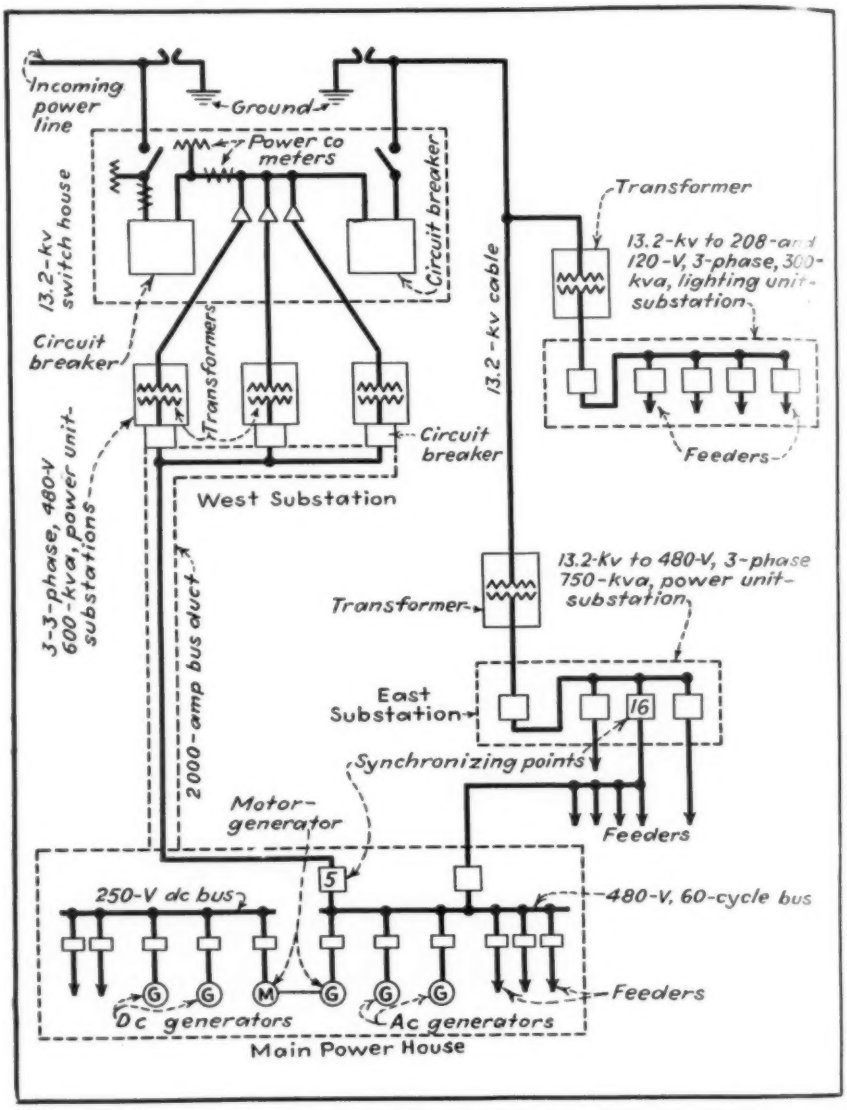


Fig. 3—Diagram of Nordberg-plant electrical system that provides for taking energy from power company lines and safe handling of generator bus during faults

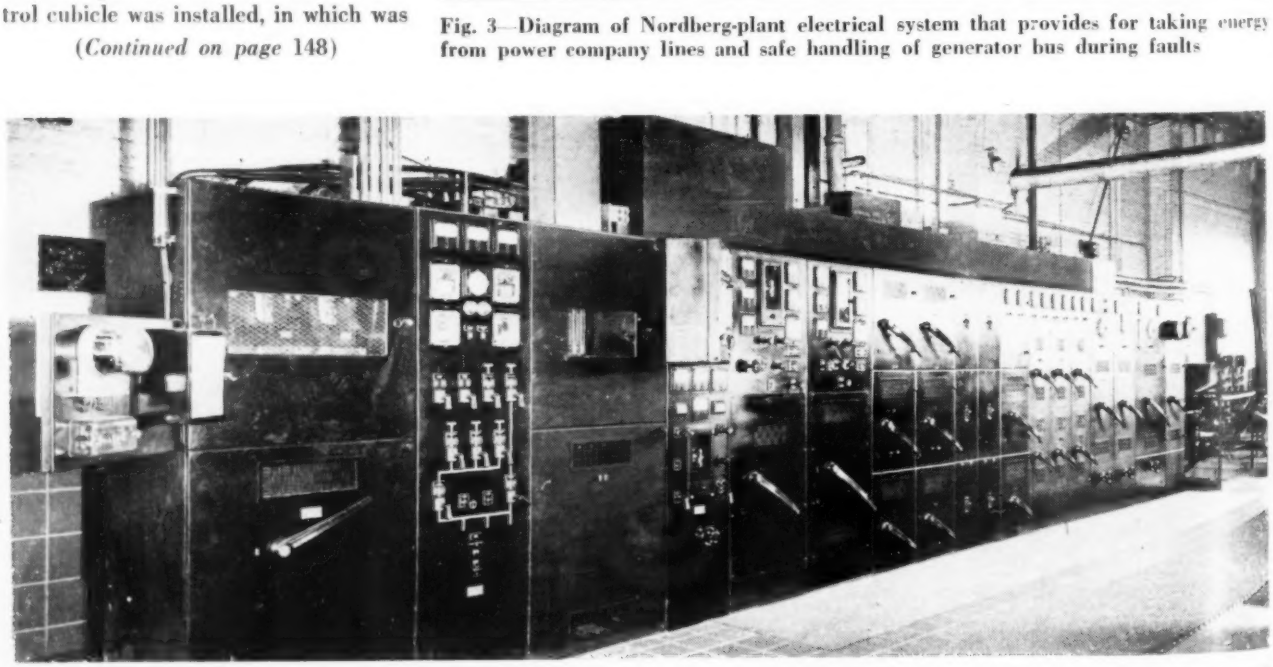


Fig. 4—In the powerhouse a centralized control cubical was installed as part of the switchboard. Panel, second from left centralizes electrical control of all main unit substation circuits and automatic load-control of other circuits

THE COST OF
Tomorrow's Peace

Today peace-loving Americans are united with thirty-three other nations in a common objective of destruction.

Millions of our fine, young men and women find themselves invading foreign lands in order that their own shores may be spared, and their free way of life preserved.

Their sacrifices will be great. Their job will be well done.

But what of the job they will expect of us when they have finished theirs . . . the job of turning their hard-won victory into a lasting pattern of peace?

Can we come up to their great expectation? We must realize that this is the last opportunity of our generation. We must do a better job of it than we did in the Twenties and the Thirties.

We have our backs to the wall, and the scars of World War I and a thirteen-year depression still are upon us. The final test of our way of life is at hand!

As we look over our shoulder into the immediate past, we see little to encourage us. But we also see much to make us pause. We see a tremendous fighting machine, created in a matter of months by the miraculous organization of our resources.

We, the largest of the peace-loving nations, have overnight become masters at the business of waging war. Today, as a result of the coordination of industry, labor, and government, we are producing ***for war alone*** as much as our total normal production for peace.

* * *

We have amply demonstrated our ability to harness the vast productive capacity we possess. Why cannot these resources, which we have organized so efficiently for the destruction of life and property, be directed toward the destruction of the causes of war?

May not the patriotic and emotional strength and the unity of action which have been stimulated for the purpose of winning the war be directed, at least equally well, toward the attainment of world peace and international harmony?

If they are not so directed, what lies ahead but another war? And how can America, in a world that is so rapidly shrinking in size, avoid involvement in ***any*** of tomorrow's conflicts?

International peace is an ambitious dream and its price is high, but the price of war is even higher. Our world cannot long survive the periodic waste of its human and material resources.

Our country can be the most potent single force in bringing about the international understanding that leads to peace, in developing the unity that will make the most of the ample resources nature has provided everywhere.

* * *

There is no unity in selfishness. There can be no unity if any one of the great powers fails to do its part in determining and eliminating from the world the basic causes of aggression.

These basic causes stem from greed and the suppression of opportunity for individual progress; for self-preservation is the first law of nature.

Mussolini's dramatic march on Rome in 1922 was made possible by disillusioned veterans of World War I who could find no jobs and whose future held no promise. Some of Hitler's most

determined followers came from the same ranks.

Men denied the opportunity to make a living, for themselves and for their children, are easy prey to false doctrines and dangerous "isms."

In any realistic appraisal of our domestic problems—economic, labor, racial—it is clear that we can solve them, not by waiting until we reach some utopian accord, but by making a series of compromises. We do this because we know how discord can impair the very roots of private enterprise, self-government, and self-discipline—the essentials of a dynamic democracy.

Similarly, peaceful reconstruction of our world economy depends on the ability of nations to reconcile their differences in a series of working agreements.

If we in the United States want lasting peace and if we want to preserve our democratic way of life, we must take over our full share of the task of initiating these compromise measures. Acknowledging our inescapable responsibility as the greatest economic and military power in the world, we must attempt to insure the free flow of world trade, and develop—with profit for both parties—backward areas abroad as well as at home. And we must do this by making all nations share the responsibility, not by allowing ourselves to be manoeuvered into being an international Santa Claus.

With our allies, we will have to see to it that the devastated portions of the world rehabilitate themselves as quickly as possible; that practicable and realistic trade and economic relations between nations are developed; and that the energies and productive capacities of these nations are set free to function in a climate that is favorable to the growth of free enterprise and individual initiative. As the most powerful economic force on earth, we have the most to gain and the most to lose at the peace table; and we must never forget that with our power comes responsibility.

We cannot hope to solve all of the problems of all nations—nor even all of our own—but our way can become the way for more of the world's humanity. Our strength can become the guiding spirit of the smaller nations.

* * *

In the development of a sound American foreign policy, let us take care not to attempt to control the destinies of other nations. Let us remember that we must set the example of self-determination of independent, free peoples.

Freedom is essential to international peace; and free competition—whether it be between individuals, between businesses, or between nations—is the mainspring, the synchronizer, and the preserver of freedom. For competition always is synonymous with private enterprise.

We are not a covetous nation. We have no territorial ambitions. Our international commercial aspirations are dominated by the conviction that we have a great stake in world unity and world prosperity. We know that we can no longer live apart from other nations and that we cannot ignore the fundamental elements which affect the well-being of other countries.

Our foreign policy must encompass a world of trade, and help develop it.

We dare not blunder in the execution of that foreign policy if the American way of life is to survive. A democracy resolved upon isolation is doomed in the world of tomorrow.

Let us resolve that out of this devastating catastrophe we shall emerge with fuller understanding and greater determination to build the kind of world which can materialize only if this country has the vision and the will to see it through.

We still are free to decide our own fate—still free to shape our own future. We still are free to preserve the liberty and happiness that has made our country the hope of the world.

President, McGraw-Hill Publishing Company, Inc.

Classify Your Power Costs

Whether your plant buys or generates power, here is a plan outlined by B J George, industrial engineer, that you can apply profitably to the elements affecting its cost

▶ EVERY OPERATING ENGINEER must study power cost. The same general principles apply whether a company has provided and maintains its own power-generating equipment or whether a public utility performs those functions. In either case, the costs of planning and design, financing, installation, operation and ultimate replacement must all be met and ultimately charged against the product or service that uses the power.

When a manufacturer furnishes his own power, he determines the costs, which usually appear on the books largely as an accounting procedure. The engineer must be familiar with those cost figures since only by knowing them can he properly assist in economical production and use of the power service.

On the other hand, when a factory purchases its energy supply, costs are determined through application of rates to the units of service required and received by the user. Here again, the engineer must be familiar with power costs from month to month and year to year. However, to use the service efficiently, it is no less essential that he be familiar with the service rates and plant-operation factors which affect power cost. Here are the fundamentals relating to power costs, whether generated or purchased.

Most operating engineers recognize two broad classifications in the production of products and services: (1) *Investment costs* provide and maintain capital investment in land, buildings, machinery and working capital. They include interest, risk and profit, taxes, insurance, and depreciation; usually they run from 10 to 20% per annum on the total investment. (2) *Operating costs* provide supplies and keep the plant in repair and operating condition to produce the product or service. A power plant includes here fuel, lubrication, water, and other supplies, labor, repairs, and maintenance.

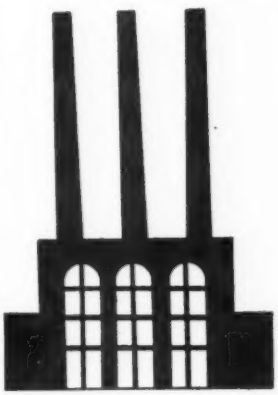
Although this classification is simple and perhaps preferred from an accounting standpoint, it is not so suitable for a study of how the operation of power-utilization equipment affects over-all power costs. So it is better to divide them broadly into fixed and variable costs as in Table 1. There are certain fixed costs which, for a plant of a given capacity do not vary with kw load or total kwhr generated so long as capacity is not exceeded. It is apparent that fixed-capital costs, which include interest, taxes, insurance, and to some extent depreciation, are constant for a specific plant and will not increase as the peak load increases toward plant capacity, or as the units generated approach output capacity.

In a similar manner once a given-capacity plant is provided, it must be manned with a minimum operating and maintenance labor and supervisory force, the costs of which are fixed and independent of plant load and output so long as its capacity is not exceeded.

Remainder of the costs are those which vary largely with plant output. Thus fuel, supplies, repairs and maintenance, depreciation (to some extent), and labor for additional shifts or more intensive output, vary almost directly with kwhr output of a given electric-power generating plant. Here is an over-all picture of this classification:

1. *Fixed costs*—overhead or capacity—the magnitude of which depends upon plant capacity, or maximum rate of output, include: (a) *Capital or investment costs* exist even though the plant is not in use, and consist of interest, taxes, insurance and depreciation (especially

Table I—Broad Classification for Fixed and Variable Costs



Fixed Operating Costs*

1. Labor: for operation, repair and supervision
2. Fuel and supplies for banking and standby
3. Accounting
4. Depreciation from operating at light load

Fixed Capital Costs*

1. Interest
2. Taxes
3. Insurance
4. Depreciation

Variable Operating Costs

From greater use of equipment

1. Additional fuel
2. Additional supplies
3. Additional labor
4. Increased depreciation
5. Increased repairs

* *Some costs, for a given plant capacity, do not vary with kw load or the kwhr generated*

Table II—Annual Power Cost for 500-Kw Plant: Investment $100,000

Classification		*Total Annual Cost*	*Cost per Unit of Plant Demand or Output*
I. Fixed Costs			
1. Capital Costs:	$15,000		
2. Operating Costs:	5,500		
Total		$20,500	$68.33 per yr per kw
II. Variable Costs		7,200	1 c per *useful* kwhr
Total Annual Cost of Power		$27,700	$92.33 per yr per kw or 3.1 c per *useful* kwhr

from obsolescence and ordinary decay). They represent an annual fixed charge usually reckoned as a percentage on the total investment. (b) *Operating costs* when a plant is manned for service include: Labor for operation, repairs and maintenance, and supervision; fuel and supplies for banking and standby; accounting and other general expenses; additional depreciation from wear and tear in operating at no load or light load. This depreciation is in the nature of a deferred maintenance rather than a fixed investment cost, but may be included in (a).

2. *Variable costs*—operation—magnitude of which depends upon plant output, include: additional fuel, supplies and labor; increased repairs and maintenance and increased depreciation due to greater use of equipment. They are essentially proportional to unit output and in a power plant may be expressed as so many mills per kwhr. This classification makes it comparatively simple for an engineer to determine what effect an operation plan might have upon over-all costs. Such knowledge is of special assistance when he has to consider changes in plant or power use since he can translate the proposed changes into over-all power costs.

Production Cost

When considering the cost of producing power in the light of this classification, even when a firm generates its power the engineer must consider whether power thus generated is being used most effectively, that is, whether: (1) unnecessary peaks are being established (2) overloads and installing additional generating capacity can be avoided by staggering or spreading out operation (3) a proposed operation introduces only variable costs which end with the operation or (4) whether costs are introduced which, in part at least, must continue on after the operation.

Moreover, in any plant, power cost to be charged against the product manufactured or the service rendered, and for which power is supplied, actually consists of two items: (1) a fixed or a demand charge per unit of demand, say in kw (2) a variable or energy charge per unit of output, say in kwhr produced and supplied. Whether electric power is generated or purchased, these two elements must be considered by either plant owner or public utility.

To apply the foregoing classification, assume that a 500-kw manufacturing power plant represents an investment of $100,000, including land, buildings, working capital, and production facilities; further, that the useful maximum demand is 300 kw and the energy produced and utilized in manufacturing is 720,000 kwhr per year. With *fixed* charges (investment at 15% per year, or $15,000; operating and maintenance labor and other operating expenses at $5,500 per year) and with *variable* expenses (one cent per kwhr of useful output) annual power cost may be set up as in Table II.

Of course, as demand on the plant increases, unit fixed costs or, shall we say, the demand charge decreases. With normal ranges, variable costs per kwhr do not materially change; hence the engineer might reasonably assume that his power rate, chargeable monthly to the manufacturing division, would be approximately $7.70 per month per kw of maximum demand (based upon year's highest demand) plus one cent per kwhr delivered at the switchboard. On the other hand, he might assume that the reasonable approximate rate would be 3.1 cents per kwhr.

In the first case, were such a charge or rate established by management, the manufacturing division when considering its month-to-month costs, should be mindful that an increase in demand not only would increase the costs chargeable to it but also might require a new reserve unit. On the other hand, the straight-line meter rate, or flat rate per kwhr, tends only to make the manufacturing division limit its energy usage, independent of the maximum rate of usage. This might lead to unnecessarily high peaks that require placing additional power generators in operation.

Personally, I prefer in such a case that the safe, reasonable plant capacity, after allowing for reserve capacity, be considered as 400 kw, and to assume a demand charge of approximately $4.25 per month per kw of demand plus one cent per kwhr, with a minimum maximum demand of 400 kw. Then accounting, manufacturing, and power-production divisions, as well as management, always would have a reminder that two general elements enter into power cost, both of which may be influenced greatly by the rate, quantity, and time of use of power throughout the plant. Actually, in most cases the accounting department sets up fixed capital charges on an annual basis and charges them against some phase of operation usually along with similar charges and the firm's remaining fixed investment charges.

Labor and other operating expenses are charged monthly in a similar manner with the result that neither manufacturing and power-production divisions nor management have at their finger tips essential cost figures to operate the power production and utilization facilities efficiently. It seems logical that whether power is generated or purchased, its cost should be known and segregated and above all that those concerned should know the facts which influence its cost.

A later article will discuss the general kinds of rates for purchased electric power and a few of the factors to consider when operating them.

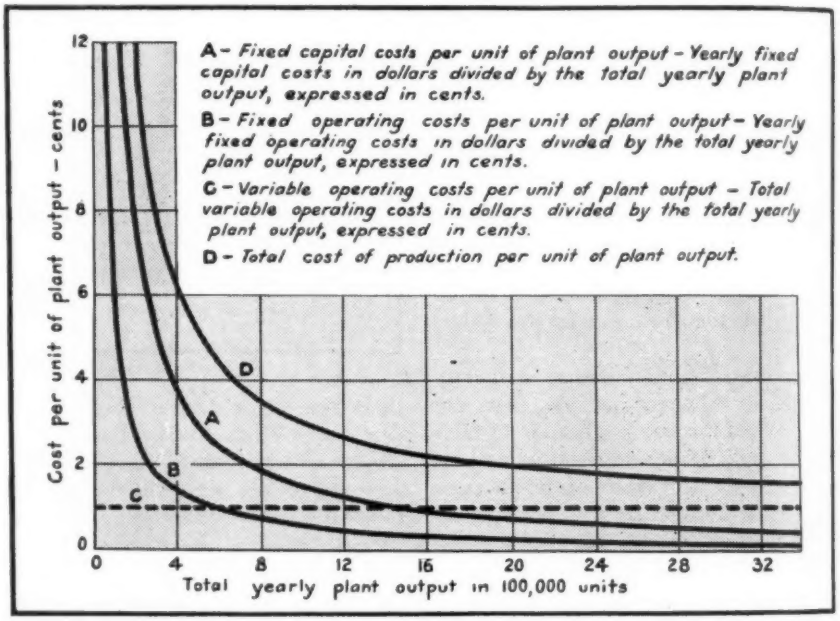

A – Fixed capital costs per unit of plant output – Yearly fixed capital costs in dollars divided by the total yearly plant output, expressed in cents.
B – Fixed operating costs per unit of plant output – Yearly fixed operating costs in dollars divided by the total yearly plant output, expressed in cents.
C – Variable operating costs per unit of plant output – Total variable operating costs in dollars divided by the total yearly plant output, expressed in cents.
D – Total cost of production per unit of plant output.
Cost per unit of plant output – cents
0
2
4
6
8
10
12
A
B
C
D
0
4
8
12
16
20
24
28
32
Total yearly plant output in 100,000 units

Fig. 1—Cost per unit of output for any manufacturing plant or a division of a plant can be analyzed. Curves show how number of units output affect cost per unit

J A KRUG

Krug Says Power Pooling Saved 2½ Million Kw

In farewell talk to Midwest Power Conference, Office of War Utilities chief reviewed war power program that "got along without" 4 million kw of "essential" new construction

▶ POWER OUTLOOK for 1944 and 1945 is encouraging, reported J A Krug as he left the Office of War Utilities in the capable hands of Edward Falck, long deputy director, to join the U. S. Navy. Schedules for a few new installations will probably be rushed, he added, but others may be moved back. Forward planning for increased postwar use of electrical energy by industry, by home appliances and possibly by special new developments such as the heat pump are future problems of the power industry.

Following out this thought, Alex Bailey, Commonwealth Edison, told the Conference that forward planning is not new to the power industry but that such planning as is being done now must be flexible to accord with industry reconversion and to provide for a great increase in the horsepower-per-worker ratio, a trend which is sure to continue.

In reviewing the power program, Mr Krug explained that the early months of war saw the Navy and Maritime Commission in desperate need of turbines and related equipment which meant that every land turbine built left one less for a ship. Passing over official estimates of need for new capacity (some as high as 20 million kw) a group of experts generously loaned WPB by utilities, manufacturers and federal agencies untangled production schedules and gave the green light to about 11 million kw which was later pared to a "glovelike" fit of only 7 million new kw.

Mr Bailey presented charts of estimated postwar power needs for the Chicago area and for three other utility systems. Fig. 1 shows kwhr estimates for the first full year after reconversion of industry for these systems and one prediction for the United States as a whole. The most optimistic indicates that kwhr output in the specific area will exceed 1943 in the third postwar year. Another estimate anticipates a drop of 18% below 1943 with a relatively slow recovery. The estimator for the nation is so pessimistic that he predicts a drop of 22% below 1943 in the first year. The average of the four systems, however, shows a drop in the first postwar year of 13% with a recovery to within 5% of 1943 in the third year.

Estimates of maximum demand for the same four groups, Fig. 2, indicate a larger increase in peak load as compared with kwhr partly because of a change back to standard time and partly by reduction of multiple shifts in industry. In general, deep-freeze units, ranges, water heaters and other peacetime load builders have a lower load factor than war industry, and require more kw of plant per kwhr of use.

Forecasts for the Chicago area, Mr Bailey said, are being continually made and revised, not only for the immediate future but for several years ahead so that long-range plans can be made. Customers are divided in five classes, rural, residential, commercial, industrial and electric railroads. Kwhr sales to each of these are shown in Fig. 3. After sounding out customers as to their plans and rechecking all conditions which might

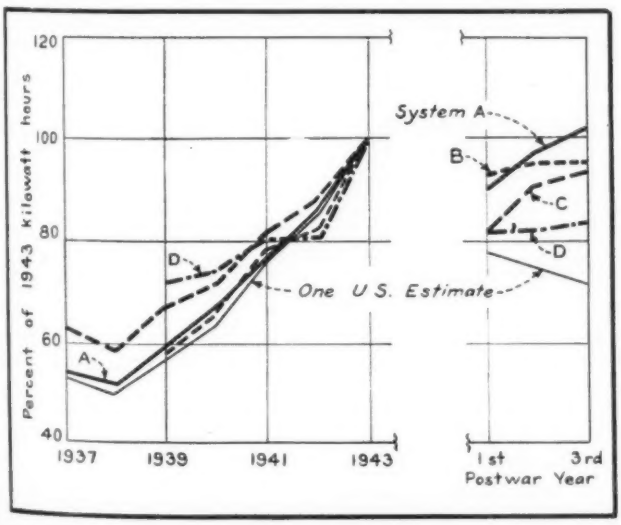


Fig. 1—Four utilities have estimated the postwar trend in power use in percent of 1943 experience (Bailey paper)

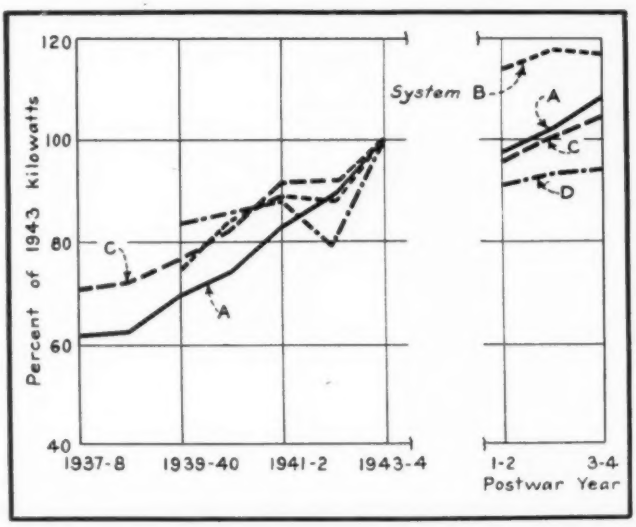


Fig. 2—Three utilities out of four expect peaks will exceed those of 1943 two years after reconversion (Bailey paper)

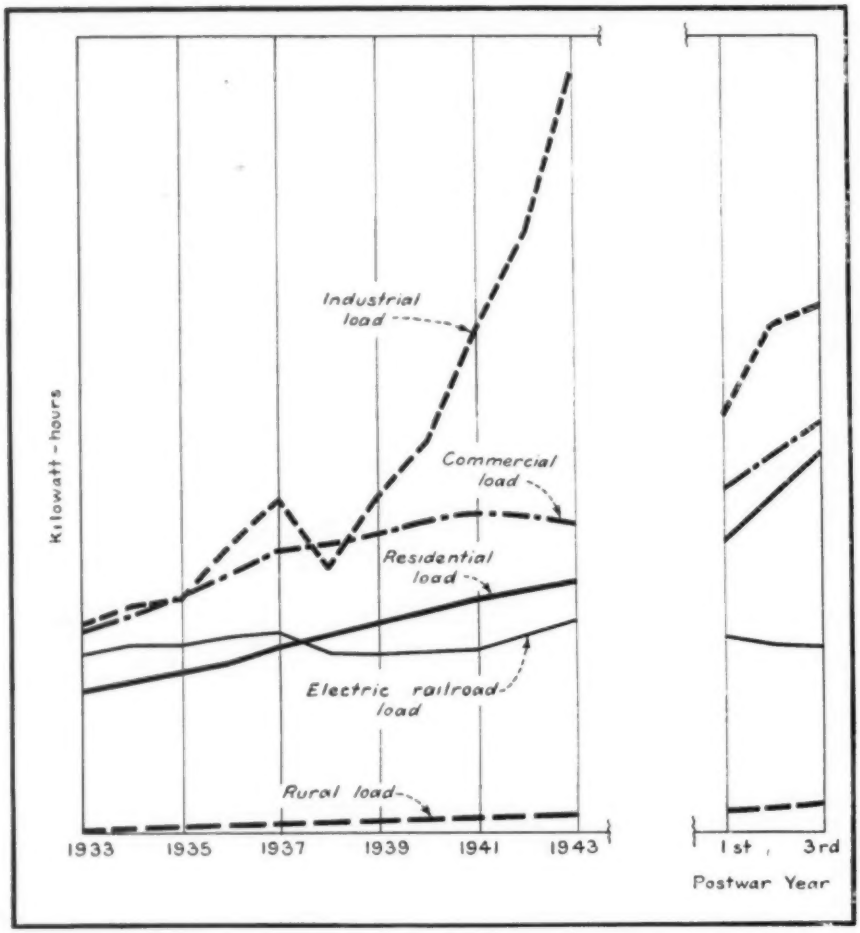


Fig. 3—For the Chicago area industrial load is expected to fall sharply during reconversion period but will climb fast from about prewar level (Bailey paper)

influence loads in any given classification, it is estimated that with proper sales campaigns, residential load will double in the first five postwar years. Rural loads may more than double. Commercial loads will recover promptly to levels higher than at any time in the past. The railway load will probably taper off gradually as gasoline and tires for automobiles become available. Industrial load will probably drop back nearly to the 1940 level and from there on will begin to rise.

Evaporative Coolers For Diesel Engines

Dodging all the ills of jacket scale, closed-circuit cooling of diesel engines is highly attractive from the operating standpoint, reported William Goodman, Trane Co. Because the same water circles through jacket and cooling coil day after day, scale can't form. This makes it safe to run the engine jacket much hotter than with open-circuit cooling. Instead of 120 F, say, the water in a closed circuit may safely leave the engine at 175 or 180 F. This increases engine efficiency and maximum power.

On the negative side, the user of closed-circuit cooling must spend money to remove heat from the cooling coil. No matter what the inlet and outlet temperature of the jacket water may be, this discharged heat runs from 2500 to 3800 Btu per hphr.

Where direct coil cooling by raw city water or well water is not economical the coil may be placed in the bottom of an atmospheric tower with the spray water falling over it. Or it may be incased in an evaporative cooler with water dripping down over the coil while a fan blows air upward over the wet surface.

Following are other practical points in Mr Goodman's paper: Higher jacket temperature greatly reduces the size and cost of the evaporative cooler. For a 1000-hp engine and a 10-F jacket-water rise, an evaporative cooler costs about $3300 for 120 F leaving the engine, $2300 for 150 F and $1900 for 160 F. The higher temperature is the best choice in all respects, giving better engine efficiency, more power, cheaper installation and lower operating costs.

The cooler is usually inside the engine room, close to an outside wall. Don't attempt to heat the engine room with the moisture-laden discharged warm air. The cooler requires no special foundation; it can rest directly on a 4-in.-thick concrete floor, Mr Goodman concluded.

Mumford Points Road To Smaller Furnaces

To save dollars by making small boiler furnaces do big jobs, we need more fundamental research on combustion rates, ash behavior and furnace geometry, declared A R Mumford, Combustion Engineering Co. His main argument was that only the hot spots give trouble; smaller furnace volume will do more work if the cool spots are made hotter and the hottest spots a little cooler. In this way the average heat release per hr per cu ft can be increased without running troublesome temperatures at any point.

Other ideas in Mr Mumford's paper may be summed up thus: We must learn more about furnace shape, air jets and gas mixing, so we can make better use of turbulence, particularly in large furnaces.

Another big job for power research, said Mr Mumford, is finding out more about ash so a furnace designer can tell in advance how a given ash will act in a given furnace—particularly where it will insulate surfaces, where it will clog passages, and how much.

Lower Cetane for Diesels

After the war, smart diesel operators will go easy on fancy fuel specifications, according to Arch L Foster, refinery editor of *Oil and Gas Journal*. Mr Foster addressed the Conference as a specialist in oil refining, not as a diesel expert, but he did present evidence that diesel-oil users are laying too much stress on high cetane number in fuel buying, and that this may cost them dearly under expected postwar conditions in the oil industry.

Skipping technicalities, Mr. Foster's points boil down to these: (1) Under postwar conditions the refiner will always favor his major customers—the users of motor fuel. (2) Most gas oils of high cetane number are very well suited for cracking to gasoline—therefore must fetch a high price if withheld for direct use as diesel fuel. (3) Reported tests seem to show that a cetane number no higher than 45 is satisfactory for most diesels, particularly for slow-speed engines. (4) Because these low-cetane oils are less suitable for cracking, they are generally less costly as diesel fuel. (5) Their use for diesels should, therefore, be encouraged.

THE OPERATING ENGINEER

George Edwards *Advisory Editor*

PRACTICAL AIDS · MAINTENANCE HINTS · QUESTIONS — ANSWERS

PUBLISHED MONTHLY AS AN INTEGRAL PART OF POWER

Model Solves Valve-Design Problem

Connecting two compound-engine-driven dredge pump units to a common shaft and raising the steam pressure introduced operating problems that J S Kernachan solved with this easily made model. It enabled him to try several valve settings

THE 15-IN. PUMPS on our dredge are driven by two vertical compound steam engines at 180 to 210 rpm depending on dredging conditions. As originally built, each pump with its engine was a separate unit. But because of objectionable vibration at certain relative phases of rotation, we connected the engines through a stub-shaft to rotate as a single unit. Because peak load seldom occurs on both pumps at the same time, maximum power developed by each engine is reduced.

Some time later, the original Scotch boilers were replaced with watertube units and the steam pressure raised from 125 to 165 psi. thus increasing possible power output. Steam to both engines is controlled by a single throttling governor.

It was evident from the governor's action and sound of the engines that they were operating at light and fluctuating load. Indicator cards taken under these conditions were so erratic as to be of little value. To get an idea of average conditions we connected a steam gage in the line between governor and steam chest of one engine. At first, the hand fluctuated so wildly that readings were unsatisfactory, but by partly closing the cock on the gage line, they became satisfactory. To our surprise, with 165-psi pressure ahead of the governor valve, average pressure at the steam chest was about 80 psi.

Most obvious remedy was to shorten the high-pressure cutoff, but with the ordinary piston valve on these engines we would have obtained only a limited effect from increase in steam lap and angular advance. The other alternative was to decrease the diameter of the high-pressure cylinder bore. The manufacturers suggested a new valve and increased angular advance. We did not think this change alone would produce full governor opening at maximum load.

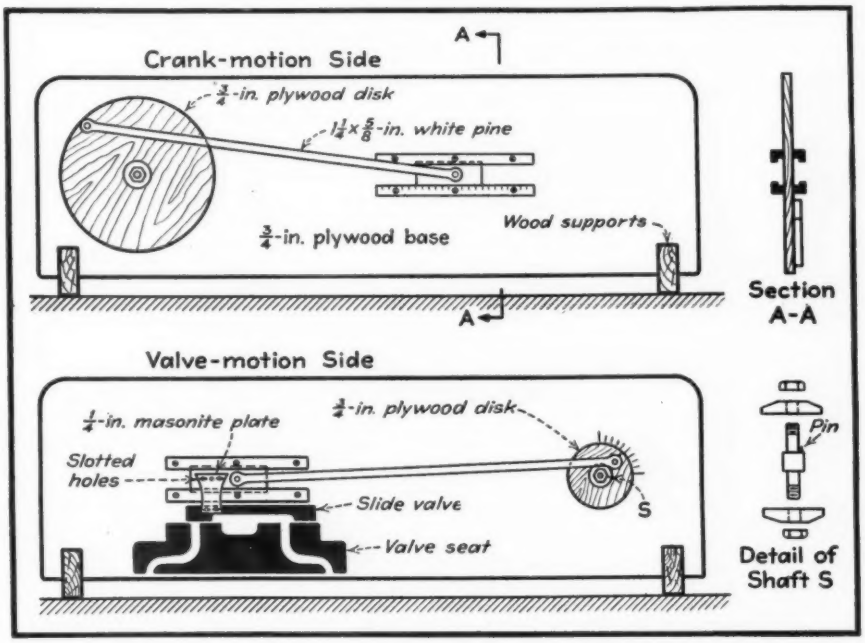


Fig. 1—A plywood board supported on its edge carries crank and eccentric disk on common shaft *S*. Scale markings on crosshead guide and at eccentric disk permit accurate settings. Valve and crosshead mount on opposite sides

To try out a number of valve combinations quickly, we constructed a model of the valve gear and crank motion, Fig. 1. The entire assembly is of wood and masonite, except the steel shaft, *S*, with its nuts and washers and also a few round head screws and washers at crankpin, crosshead pin, crosshead guide, and valve drive block.

While the valve drive on the model is not feasible on an actual engine, the motion is equivalent and this construction made it possible to shorten the model considerably. The valve is driven by a crank instead of an eccen-

tric, and a small pin in the shoulder of shaft *S* engages the crank disk to prevent slipping. Placing the crank on dead center and slacking off the clamp nut permits rotating the eccentric disk to any desired angular advance in accordance with the degree scale laid off on the base concentric with the disk. There is also a scale in inches on the crosshead guide from which piston travel can be read directly. Cross-section of the steam chest and valve is represented with black paint, while steam passages are indicated with clear varnish on the natural wood.

Valve Extension

The block on which the section of slide valve (actually a piston valve as previously explained) is painted, is slightly longer than the valve outline. This extra length permits pasting small pieces of Scotch tape on the valve to represent any desired steam or exhaust lap and, as the masonite block driving the valve has slotted screw holes, the relative amount of head- and crank-end steam lap and exhaust lap can be quickly changed.

Thus, the model can be adjusted to represent any desired angular advance and steam and exhaust lap in two or three minutes. Also, we can read off the piston positions for admission, cutoff, release and compression for each end of the cylinder by a single revolution. Further, the model gives a much clearer conception of relative velocity, or rate of travel, for valve and piston at any given position than is possible with the Zeuner diagram or any other graphic form of analysis.

This particular engine has a piston stroke of 14 in. and the center-to-center length of connecting rod is 37 in. Because the rod is short in proportion to crank radius, relation of piston position to crank angle is considerably different on the forward and return strokes. Or, for those who prefer technical terms, there is a large departure from simple harmonic motion. Because of this, we were able to use a crank-end steam lead of $\frac{11}{32}$ in., or almost four times that of $\frac{3}{32}$ in. on the head end. This is more than the manufacturer had ever used on similar engines but the results have been quite satisfactory.

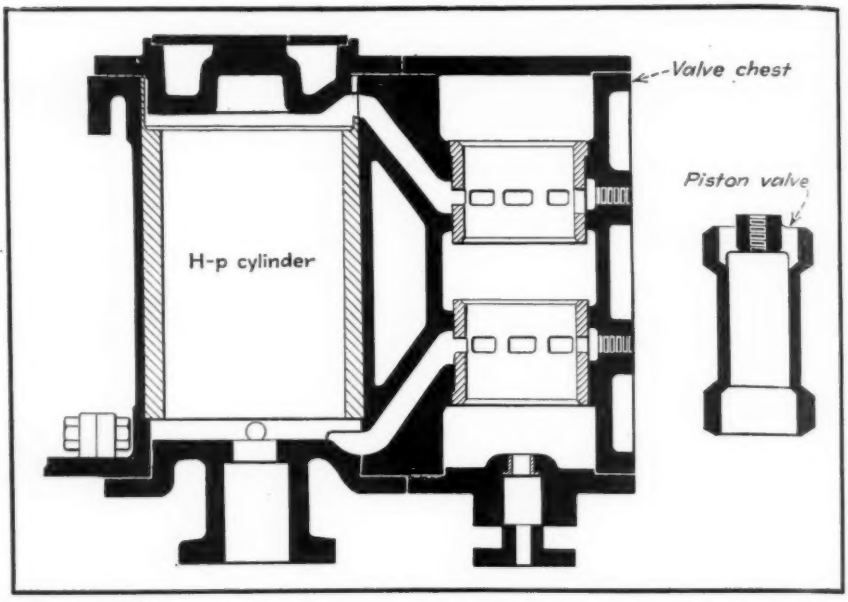


Fig. 2—High-pressure cylinders were fitted with liners to reduce internal diameter from 12 to 10 in. Pistons were turned down, fitted with new bull rings

To increase the expansion ratio beyond that obtainable by shortening the cutoff alone, the high-pressure cylinders were bushed from 12 in. diameter to 10 in., pistons turned down and new bull rings installed to suit the cylinder. This is shown in Fig. 2, which also shows the valve construction. In addition to shortening the cutoff, compression was also increased which resulted in noticeably quieter operation. Pressure at the steam chest under full load is now almost boiler pressure.

While the model was designed to solve a single problem, it is evident that by using long crosshead guides and an adjustable connecting rod, with a crank radius adjustable by having the pin clamped in a tee slot, a considerable range of crank conditions can be covered. Valve travel can be varied in a similar manner, and valve seat and slide be made with removable faces of cardboard, wood, sheet metal, or other light material. In this way, one single model is easily adjusted to represent actual dimensions for a fairly wide range of engine sizes.

As all of the dredge machinery exhausts into a common condenser, we have not been able to determine the specific improvement in steam economy accruing from the changes in these engines alone. Other improvements were made during the winter overhaul period, but they were of a minor nature.

Comparing operating records shows:

Calendar year	*1942*	*1943*
Yards pumped	886,695	1,101,855
Miles run	21,226	21,652
Fuel (gal.)	767,771	779,873

Operating time increased from 128 hours per week in 1942 to 140 in 1943. Pumping time increased from 1743 hours in 1942 to 1877 hours in 1944.

TABULATED DATA FOR THE OLD AND NEW VALVES

OLD VALVE

Head End	Crank End
Lead 1/8 in.	Lead 9/32 in.
Cutoff 9 5/8 in. = 68.5% stroke	Cutoff 9 21/32 in. = 68.8% stroke
Release 12 21/32 in. = 90.4% stroke	Release 12 3/4 in. = 91% stroke
Compression 12 23/32 in. = 91% stroke	Compression 12 5/32 in. = 86.8% stroke

Angle of advance 36 deg

NEW VALVE

Head End	Crank End
Lead 3/32 in.	Lead 11/32 in.
Cutoff 8 3/16 in. = 58.5% stroke	Cutoff 8 1/8 in. = 58% stroke
Release 12 9/16 in. = 89.7% stroke	Release 12 5/8 in. = 90.3% stroke
Compression 11 3/8 in. = 81% stroke	Compression 11 5/16 in. = 80.6% stroke

Angle of advance 45 deg

REFRIGERATION NOTEBOOK — 13

Tips on Stuffing Boxes And Special Shaft Seals

By TERRY MITCHELL, ME, *Frick Company*

IF THE SHAFT IS SMOOTH and the box long enough (and the first is centered reasonably well in the second) it is not difficult to pack the stuffing box of an inclosed ammonia compressor if a fellow follows one rule: See that the packing is tight against the inside wall of the box and not against the shaft, Fig. 2.

Rubberized packing, after being soaked overnight in ammonia oil, adjusts itself easily to contact the smooth shaft. Motion of the crankshaft, and the oil, which follows around its surface, aid in sealing the joint, but the packing must not fit too snugly as heating and swelling immediately result. A little oil leakage is to be expected at first: This either stops itself, or can be stopped by tightening the gland nuts finger tight (never with a wrench).

Fit the packing to the inside of the box as snugly as possible while still leaving about 1/64-in. clearance at the shaft. The box is seldom as smooth as the shaft, and oil is often not plentiful in the upper half of it. Be sure the oil lantern ring is directly under the lubricator or oil feed pipe. Better put in too little packing than too much: One extra ring is usually provided as a spare.

Check Shaft and Gland

If the box is not centered around the shaft, it may be either because the main bearings are worn or because the bolts that hold the shaft housing to the compressor body are not drawn up evenly on the gasket.

Freon-12 leaks through joints and seals that would hold ammonia. Preventing Freon leakage at the compressor shaft proved so difficult that special seals were developed. One of these, known as Flexo-Seal, is illustrated in Fig. 1. The actual seal is made between an alloy face (on a part corresponding to the gland used with soft packing but made tight with a gasket) and a thin, flexible steel ring. The ring is pushed against the alloy face by springs, acting against a compressible synthetic-rubber sealing ring, which is shown in solid black. Two channel-shaped rings, also of synthetic rubber, are pressed against the shaft by the gas or air behind them to prevent leakage inside the flexible sealing-ring assembly. This holds against a pressure or a vacuum equally well. For that reason it was adapted to booster compressor service with excellent results, and is now often used on standard ammonia compressors in addition to Freon machines.

In assembling such a seal, use care to keep the sliding face unscratched and well oiled. A hole or passageway above the bearing may be needed to prevent gas-binding and failure of the oil to reach the seal. The drive pins which turn the thin ring should be carefully inserted in the holes; the set screws must be accurately placed on the shaft to give the springs just the right tension: The rubber rings need to be put in place without being twisted, and the alloy face should be set exactly square with the center line of the shaft.

Small machines use a bellows seal, in which any slight *weaving* of the shaft is taken up by the flexible metal shell; pressure is provided by a spring inside the bellows to assure positive seating.

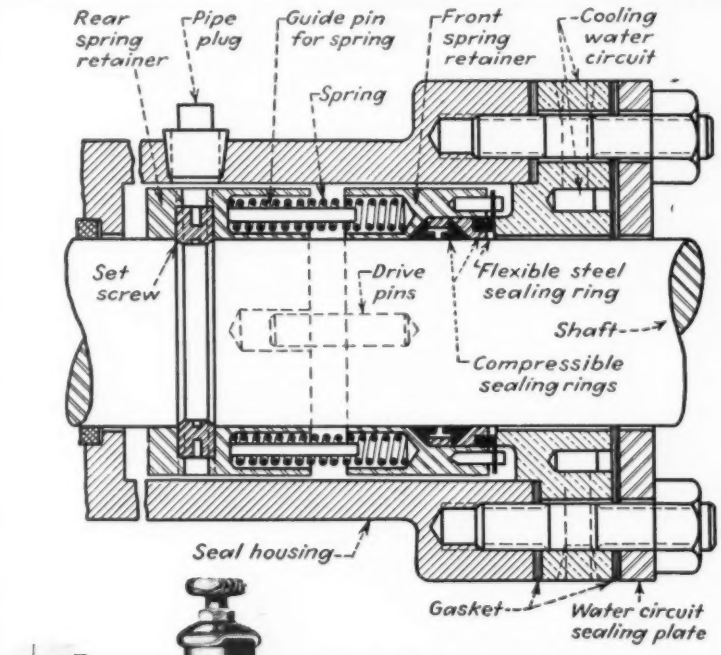


Fig. 1, *above*—An alloy face seals against a thin, flexible steel ring

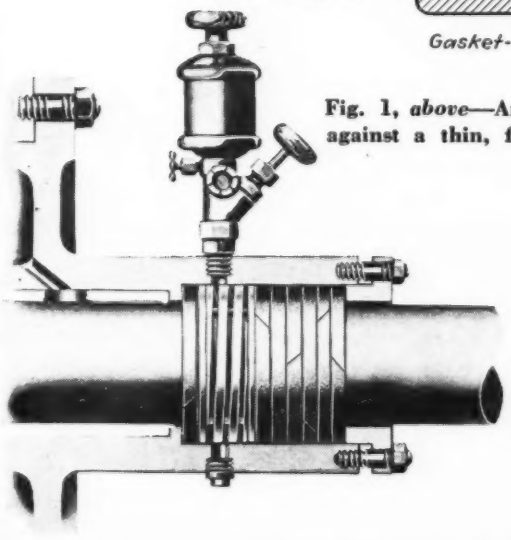


Fig. 2—Always carefully place oil gland beneath the oil inlet

PRACTICAL AIDS TO OPERATION

Track Inserts Jump Gantry-Crane Rails

PORTABLE RAILROAD TRACK INSERTS, placed in position over the gantry yard-crane rail, opened an additional entrance to the locomotive division shop at General Electric's Erie Works. Because the driving gear and wheel of the crane are practically the same diameter, a regular crossover was not satisfactory since the driving gear would hit the railroad track each time a crossing was attempted. The inserts, simple in design as shown in the photo, have proved satisfactory. Handles welded on each side facilitate handling. When not in use, the inserts are locked in a cabinet on the crane as a safety precaution. The crane man is responsible for their safe keeping and use.

Repairs Rubber Vibration Mountings on Motors

WHEN LUBRICATING small, rubber-mounted motors, I have always been careful to prevent oil getting onto the rubber and eventually destroying the bond between rubber and metal. Once I lost a bearing through too much caution: I filled the bearings, wick oiled, until oil ran out of the overflow holes. This practice eventually caused the expected deterioration of the rubber mountings.

Some time ago the mountings failed from this cause on the motors driving the refrigerating compressors on our cold room and ice-maker. Immediate restoring of the rubber mountings was not possible. The motors had to run and I repaired them as follows:

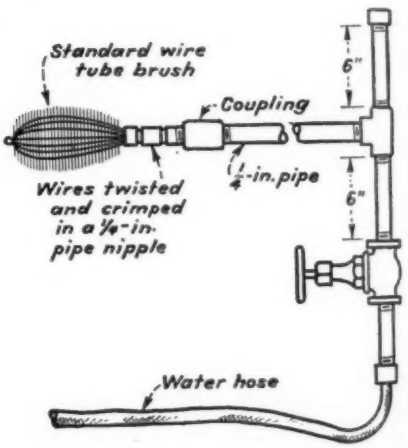
I took each motor off its base, dismantled both inboard and outboard ends and found the rubber separators a useless, spongy residue, almost completely separated from the motor and bearing plates. The inner plate fastens only to the motor frame while the outer plate is pivoted on the motor base. Nearly all vibration is taken up by the rubber separators.

Removing the bolts, holding the inner plate to the motor, I replaced them with ones long enough to go through both inner and outer plates and what was left of the rubber. After doing this to both ends of the motors the assembly functioned with only slight noise and vibration. It appears that these repairs can be permanent and will prevent a recurrence of the old trouble. The rubber now acts only as a distance piece between the two plates.

ARTHUR H PARKER
Peterborough, N. H.

Pressure Water Helps Brush to Clean Tubes

WHEN WE OPENED a straight-tube water-tube boiler we found a thin uniform layer of mud on the tube's inside surface. Since a turbine cleaner was not needed, we tried running a wire brush



through the tubes. When the brush was pushed about halfway through, the mud piled up in front of it and plugged the tube so that we could not complete the job. Still wishing to avoid using the turbine cleaner with its heavy wire wrapper hose I again turned my attention to the wire brush combined with washing water.

To do the job we connected the wire brush to one end of a ¼-in. pipe long enough to reach through the tubes as in the diagram. The intake end of the pipe we connected to a tee and two 6-in. pieces of pipe to serve as handles for manipulating the brush into the tubes. One end of this handle we capped and the other we connected through a valve and hose to a 30-psi water supply.

When tested in the open, the twisted wires of the brush gave the water a whirling motion. We then tried it in the

tubes with complete success and very little effort by the operator.

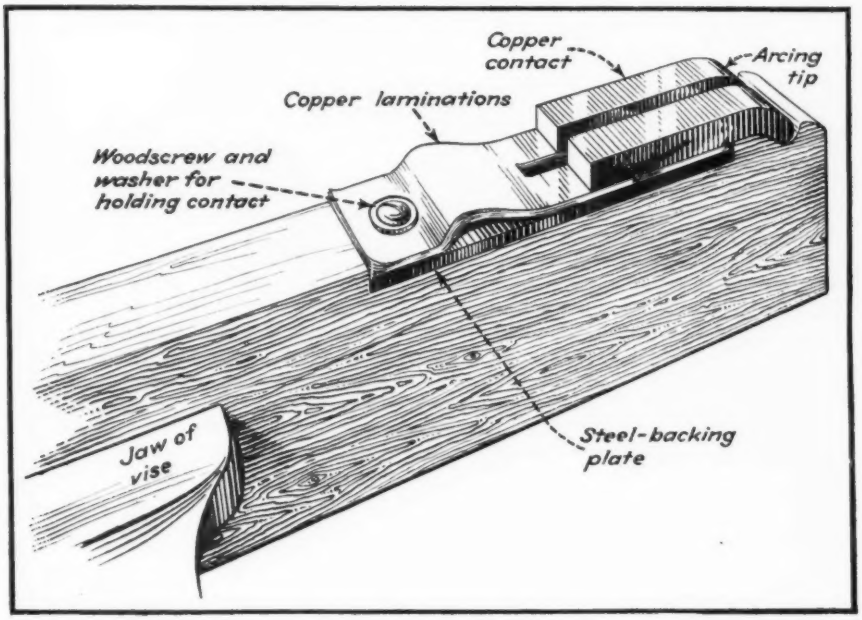
Since our almost 3000 Liberty ships are equipped with straight-tube boilers I would like to pass this kink along to the engineers who have charge of those ships' 6000 boilers and to anyone else who has to clean straight-tube boilers.

New York, N. Y. P E MEREDITH

Wood Jig Speeds Contact Resurfacing

OUR POWER PLANTS are 25 miles from the town and mill we supply, therefore we are isolated insofar as ready access to a machine shop is concerned. With the exception of the usual plant kit, we have no machine tools. We had orders to shut down both plants over Sunday and overhaul the main circuit breaker in one plant. Removal of the oil tank revealed pitted and poorly aligned contacts. We decided to draw-file the contacts and then polish with sandpaper and crocus cloth.

Having no way of holding the contacts securely and level presented a problem when we attempted to draw-file them. Trying to hold them in the vise caused them to buckle because of slot in the center, as in the drawing. This led to making a hardwood jig from a piece of wood 2x6 in., 3 ft long, held in the vise jaws as shown. Top edge of the wood I chiseled to a shape that fit the contact when it was secured in place for filing. Using a wood screw to secure the contacts to the jig, we went to work. This jig worked so well we cut another in the other end of the 3-ft piece of wood so that two men could draw-file contacts while a third man polished them. This device certainly helped to speed up the work and we had the switch ready to go into service when it was needed.



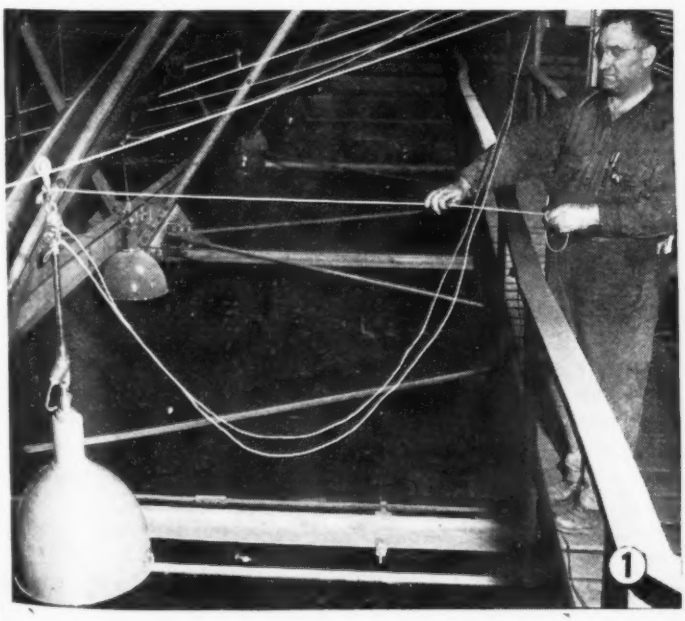
KENNETH COLLINS

Eagle River, Ont.

Lamp Maintenance Safely Engineered

CLEANING AND RELAMPING high-bay lighting fixtures is quickly, easily and safely done three times a year at the Westinghouse East Pittsburgh plant by a trolley system. Lamp fixtures hang from trolleys that ride on inclined steel cables, which are suspended between the wall of the building and the vertical center support of the roof truss, Fig. 1. The entire assembly is pulled to the catwalk that runs lengthwise of the building center. The cable is inclined to insure return of the fixture to the correct location, at which point a cable clamp is placed.

Plug and cord to the lamp fixture are pulled out of the receptacle of the safe-change hanger as a safety measure. This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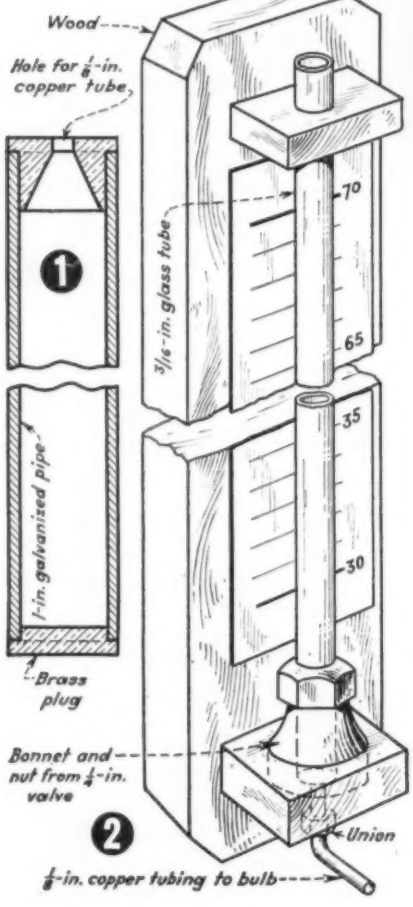
insures a dead socket during washing and relamping operations. The fixture is raised and held on the rail of the catwalk while it is cleaned, Fig. 2. Burned out lamps are replaced after cleaning; 1000-watt incandescent lamps are alternated with 400-watt high-pressure mercury-vapor lamps to furnish general illumination. The fixtures are mounted 65 ft above the floor and are spaced on about 15x30 ft centers.

Builds Eyelevel Reading Thermometer

TO ELIMINATE pulling a thermometer up by a chain from a well to read the water temperature, we made an instrument for eyelevel reading. We used a piece of 1-in. galvanized-iron pipe for the bulb, making it large to avoid the effects of atmospheric temperature on the copper tube connecting the bulb to the thermometer glass tube.



We put the galvanized iron pipe in the lathe and faced each end square and made two brass plugs, one for each end, Fig. 1. One plug is blank; the other has a center hole for a ⅛-in. copper tube and is funnel shaped on the inside to eliminate air pockets in the bulb when filling.

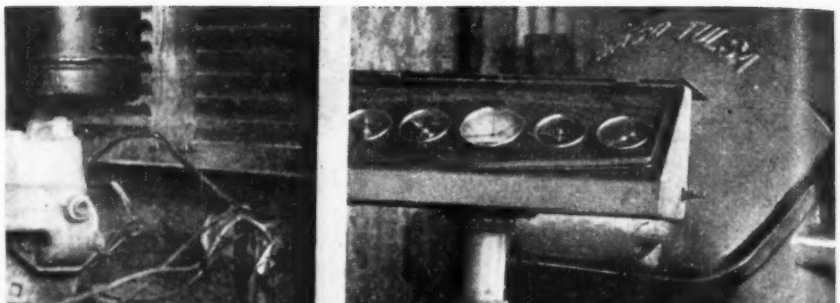
These plugs we soldered into the pipe. A ⅜-in. internal-diameter glass tube supported on a piece of ¾-in. hardwood forms the reading part of the thermometer, Fig. 2. This tube connects at its bottom end to a bonnet of a small valve and rests in a brass support, as shown. A short piece of tubing connects the bonnet to a union which in turn connects to the ⅛-in. copper tubing running to the bulb.

Several liquids having suitable characteristics were available for filling the instrument but we used ethyl glycol, which has a boiling point of about 270 F. To fill the bulb and tubing we heated a piece of ¼-in. glass tube near its center with a bunsen burner. With one end of the tube in each hand we stretched the heated section until it reduced to about ⅛-in. diameter, leaving a small passage through it. We allowed the tube to cool, then filed around where it was to be separated.

One piece of the tube made a nozzle, to the large end of which we attached a ¼-in. rubber tube with a funnel. We filled the bulb, first making sure that all air was expelled. To fill the tube we coiled it into a spiral about 8 in. in diameter.

Filling was slow but all air was permitted to escape. While holding the top end of the tube tightly sealed with the thumb of one hand we soldered the other end into the bulb. After this, the glass tube supported on its base was coupled to the tubing and filled until liquid showed in the glass.

To calibrate the instrument we immersed the bulb in 40-F water and brought the liquid level in the tube to



Instrument Panel Made Shockproof

SHOCK TRANSMITTED from a reciprocating pump and its driving engine affected the accuracy of indicating instruments that showed operating conditions of the power unit. To eliminate this difficulty the operator sawed in two the instrument-supporting pedestal and connected the ends by hose held to the pipe ends with clamps, as in the photo. Tubes and flexible shafts, attached to the vacuum, oil pressure and temperature gages, ammeter and tachometer were brought up through the pedestal and connected in the usual manner to the instruments at one end, and to the engine at the other end.

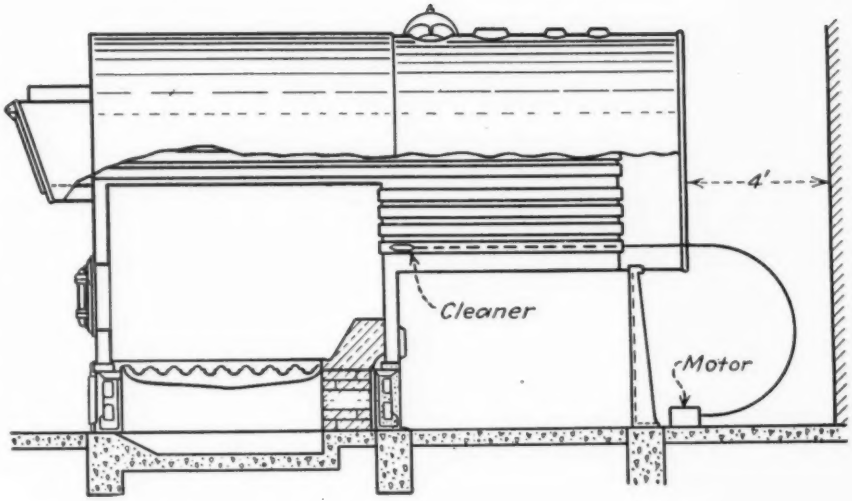
Santa Monica, Calif.

J C ALBRIGHT

where we wanted this graduation to be on a temporary scale. Then we raised the water temperature to 70 and made another mark. Intermediate marks on the scale were proportional to these two.

We then removed the temporary scale and from it laid out the permanent one for the thermometer with a range of 30 to 70 F. The scale was then installed back of the glass tube when the bulb was at a known temperature, to get a location point for the scale. A thermometer made in this way is as accurate as the thermometer used to calibrate it, but its scale divisions are more easily read.

Hamilton, Ont. J A COULDEN



Flexible Shaft Drives Tube Cleaner

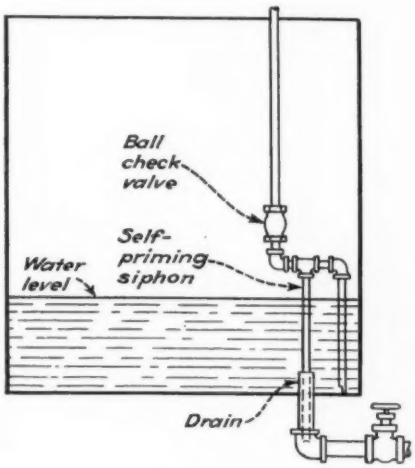
A HORIZONTAL-RETURN-TUBE BOILER in our plant is set with its rear end 4 ft from the wall, as in the figure. As a result, the short tubes running from the firebox to the rear tube sheet could not be cleaned except on holidays when the boiler could be cooled down so that a man could work the tube cleaner from within the firebox.

To overcome this difficulty, I cut the boring tool from the end of the 16-ft flexible shaft of a device used by plumbers for cleaning drain pipes. In place of the tool I welded on a boiler-tube cleaner. Now, driving the tube cleaner with drain-pipe-cleaner motor we run it through the short tubes from the boiler rear each week. Before these tubes are cleaned, they now have a thin white coating where before they had a heavy soot covering. The long tubes never gave any trouble because they could be cleaned from the front end through doors below the stack connection.

Greenhills, O. JAMES LEE

Self-Priming Siphon Drains Tank

WE HAVE a hot-water storage tank in which the outlet pipe comes up about 5 in. above the tank bottom, as in the diagram. To drain the tank completely we use a self-priming siphon, as shown. Its long leg goes down the drain pipe and the short leg rests on the bottom of the tank. At its lower end the short leg



is cut back about ¼ in. across one half the pipe diameter to permit free flow into the siphon. A ball check valve connects into the free end of the tee connecting the two siphon legs.

When we want to drain the tank dry, we first draw the water down to within about one foot of the bottom and then position the siphon as in the diagram. Most of the air is forced out of the siphon up through the ball check valve. Remainder of the air is pulled out by the water in the drain flowing by the end of the long leg, and the siphon then primes. It continues to operate until practically all the water is drained from the tank.

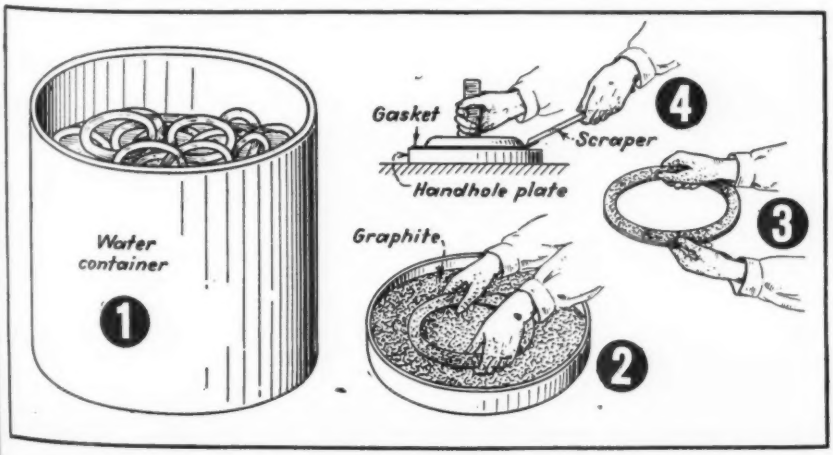
Denver, Colo. G A BANKERT

Objects to Oil and Graphite on Gaskets

EVERY ENGINEER realizes the bad effects of oil in the boiler, yet some coat boiler handhole gaskets with a cylinder-oil-and-graphite mixture. Oil from several hundred handhole gaskets is not beneficial to any boiler. The oil can be omitted because its only purpose is to bind the graphite to the gasket.

I have found that water may be substituted for oil by soaking the gaskets for several hours before using them, Fig. 1. After they have been thoroughly soaked, dip them one at a time in a pan of graphite, Fig. 2. To completely coat the gaskets, rub the graphite into them by hand, Fig. 3. Then press the gaskets onto the handhole plates with a metal scraper, Fig. 4. This is easily done because the wet gaskets will stretch over the plates without damage. I have found that this method requires less graphite than the oil-and-graphite mixture that we formerly used.

Great Neck, N. Y. S M ELONKA



READERS' PROBLEMS

Questions From Our Readers

Question 1

What Causes Pressure Variation?

WE HAVE TWO HAND-FIRED BOILERS facing two stoker-fired boilers with firing isle between. Each pair of boilers connect to a short header which in turn feeds the main steam line, the stoker-fired boilers being farthest from the load. Main steam gage and pressure control for automatic stokers connect to main steam line midway between the two sets of boilers. No. 1 and 2 are hand fired and 3 and 4 are stoker fired. Automatic stokers cut in at 85 psi and out at 95 psi. No. 2 boiler was recently overhauled and thoroughly cleaned.

We experience considerable trouble when No. 2 and 4 boilers are operating. On occasions when pressure on No. 2 is 95 psi, No. 4 shows 85 psi and the main steam gage, 87 psi. No. 4 stoker cuts in when main gage shows 85 psi even though No. 4 boiler pressure has dropped to 80 psi and No. 2 boiler registers 90 psi. This procedure sometimes reverses with No. 4 boiler showing 95 psi, No. 2 85 psi, and main steam gage 95 psi.

This trouble has appeared only since we overhauled No. 2 hand-fired boiler and when we use it with one that is stoker fired. All steam gages have been checked and found accurate.

Could this trouble originate in the boiler non-return stop valves or is it caused by unequal firing between the hand- and stoker-fired boilers? What can we do to correct this condition?—*CRF*

Question 2

What Is Finger Tight?

HOW OFTEN HAVE WE HEARD the expression, "make packing-gland nuts only finger tight," to explain how to repack a gland. Authors also say that a centrifugal pump packing gland should leak enough to cool the packing. But what about the outer rings on the suction side of pump? Single-intake pumps usually carry a water line from the pressure side to a lantern ring inserted midway of the suction-side packing gland. Since all the water leaks inward on this gland shouldn't the sealing line and lantern ring be located at outer end of gland?

Making packing-gland nuts finger tight is simple on small glands but how is it done on large or vertical machines that use heavy glands? Isn't there more danger from leaving the packing loose, permitting pressure to get behind it, than from making the gland too tight by using a wrench properly?

A certain area of the inner packing ring being subjected to the internal pressure moves to take up any space left by a slack gland. This movement permits pressure to act over progressively greater areas of the inner ring until it is away from the gland shoulder and full pressure is compressing the packing against the gland follower. If this is true why shouldn't packing be made tight enough originally to hold it against bottom of gland?—*LCR*

SUITABLE ANSWERS from readers will be paid for if space is available for publication. Answers that are accompanied by rough drawings or photographs will command additional pay.

Answers to April Question 1

Should Blowers Be Shut Down?

WHEN SOME FIREMEN *coal hand-fired boilers, using forced draft and burning bituminous run-of-mine coal, they leave the forced-draft blower running while firing doors are open even though flames come out and threaten to singe them.*

They explain that shutting the blower down while refueling permits the fine coal to cake on top of the fire bed, which prevents free flow of air when the blower is restarted and lowers boiler performance.

As coaling takes only about 20 sec at each door their explanation appears grossly exaggerated. In plants using natural draft, be it ever so strong, there is no such complaint although when firing door is open stack draft has no effect on fuel bed.

Is there any basis for this reasoning on forced draft? If so, what convenient method can be used to adjust the air pressure, while doors are open so that flames do not emerge, and yet prevent fuel surface from caking? Is this just an excuse for not taking the trouble to shut the blower down? Can we overcome this by installing a blower-motor control switch on boiler front?—AAB

Firemen Are Wrong

IT IS DOUBTFUL whether AAB's firing methods are necessary for proper boiler performance. Under the conditions mentioned he seems justified in his opinion of the firemen's explanation. It gives the impression that forced draft separates the various sizes of coal at each firing, thus holding the fine coal in suspension over the fire while the coarser portions drop to the fuel bed.

The fact that no similar complaint about caking is made in plants using strong natural draft seems to show that the practice could be discontinued without bad results in caking fires.

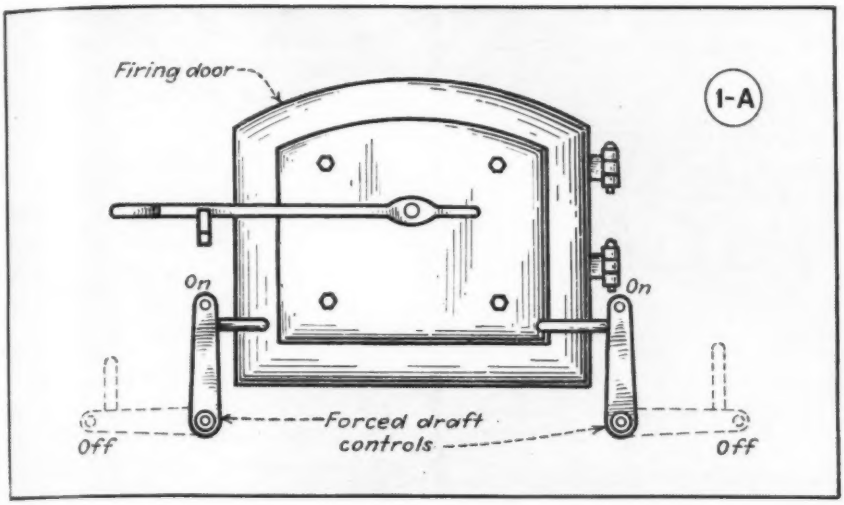
It appears that control of the forced draft can be effected only by stopping the motor-driven blower. Here the plant falls short of devices usually found in such installations. The forced-draft duct should be fitted with an air gate or damper, by which the air supplied to each boiler could be shut off or regulated as required, without affecting the draft to any other boilers. Placing the controls of these dampers on the boiler fronts within convenient reach of the firemen should improve operation.

Jersey City, N. J. I S CHAMBERLAIN

Control on Firedoor

LEAVING THE FORCED DRAFT ON while the firedoor is open is inexcusable and dangerous. Many eye injuries, singed scalps and eyebrows attest to this fact. This was a common practice with marine firemen years ago until circumstances demanded a remedy. The remedy was applied to the Howden forced-draft system on Scotch marine boilers by simply adding an extension on the arm of the air-control lever, sketch 1-A.

This extension passed over the fire-



door when the lever position was *on* and thus prevented opening the door while the air supply was on this furnace. Each firedoor, of course, was part of an independent or semi-independent furnace, as this boiler is designed to be fired from one or both ends respectively.

If AAB has a single-furnace hrt boiler I suggest, to control the fan motor, that he install an electric switch to be operated by the opening and closing of the firedoor.

If a number of furnaces are served by one fan, some mechanical arrangement will have to be designed to operate each furnace draft supply from the individual firedoors, opening and closing louvers as desired.

Kearny, N. J. GEORGE MCNALLY

Fan Keeps Fines Suspended

SHUTTING OFF THE fan while coaling a forced-draft furnace does permit the fines of a caking coal to fuse on the firebed before they ignite. Running the fan while coaling keeps the fines suspended in the upward current of air so that they are ignited before they sift through the lumps to form a fused mass. Unless the fires have been freshly cleaned, fusing occurs much more readily in a forced-draft than in a natural-draft furnace. This is because furnace temperatures are higher and fuel bed is thicker, with its greater store of heat only slightly quenched by the green coal. With the fan idle and natural draft eliminated by the open furnace door, the finer coal particles settle to melt on the fuel bed.

Caking of the fines forms a crust which offers a higher resistance to air flow after the fan is started. And as soon as the doors are closed, stack effect creates a partial vacuum. Under the greater-than-normal pressure differential the fuel bed lifts in its weakest spots, the crust breaks and holes appear.

Obvious solution is to install stokers to supplant hand firing. If this is impossible, place a control within easy reach of the firemen to reduce fan speed during coaling. If the coal cakes readily, their explanation is not grossly exaggerated.

Marissa, Ill. GEORGE HOLMAN

Use a Damper

IF AAB IS CARRYING too thick a fire, the firemen are right (about the fires caking whenever the forced-draft fan is off).

A simple solution is to install a damper between the forced-draft fan and boiler. If space permits, install an extension rod or some similar arrangement to operate the damper from the front of the boiler, sketch 1-B.

After a few trials the firemen learn just how much forced draft prevents the fuel caking, yet keep the flames from coming out the doors.

Brooklyn, N. Y. A J WENIG

Suggests Automatic Switch

A GOOD FIREMAN ALWAYS KNOWS how to get best results from a boiler with the least energy. I once had a similar difficulty upon taking charge of a plant. Instructions to shut off the blower when refueling did not meet with success. We incorporated an additional start-and-stop button for the blower within easy reach of the firemen, assuming that they would adhere to instructions. But far from it. We were forced to devise something else.

We installed a switch on each firing door and wired the switches in series so that opening the door reduced the blower speed to a safe margin, enabling the firemen to refuel safely.

Highland Park, Mich. CARL BACHMANN

Install Stokers

NO TWO FIREMEN fire a boiler alike. Some maintain a fire (including ashes) 16 in. thick, others have a bed 5 to 6 in. thick.

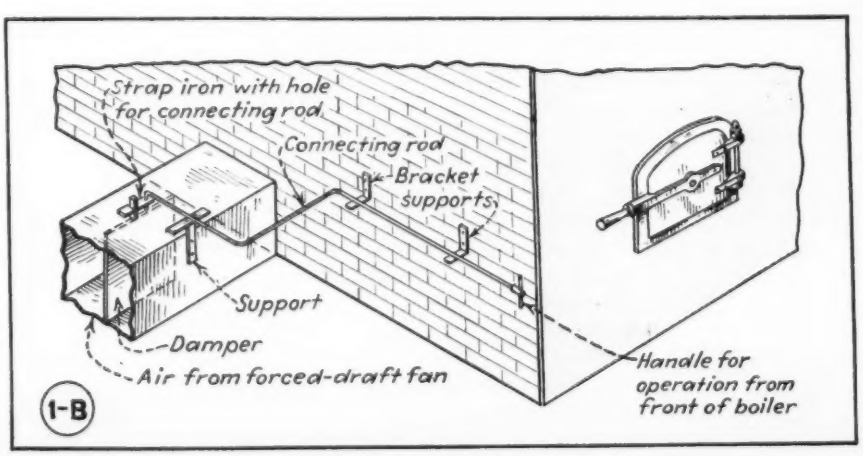
Some firemen control the undergrate draft by hand-operated windbox dampers, others by adjusting the rheostat for electric-motor drive.

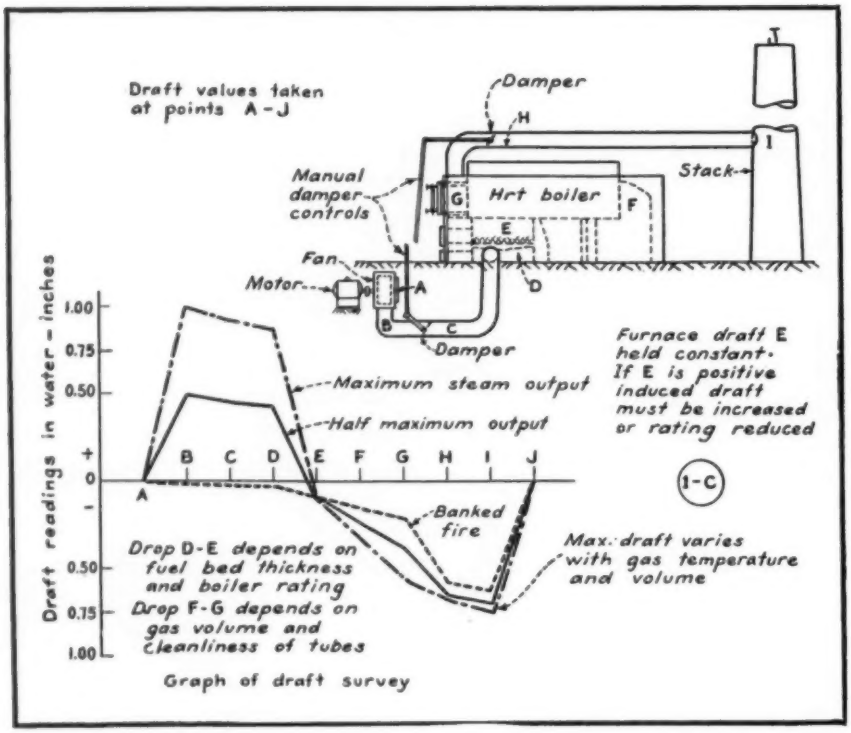
For convenience use a switch to control blower motor speed. If firing methods are proper and blower speed is reduced, and if hand firing is to be continued, hot gases and flames from the furnace should give little trouble.

Fairview, N. J. M N GOZDENOVICH

Hold Furnace Pressure Below Atmospheric

IT IS IMPORTANT to maintain furnace draft slightly below atmospheric at all times including firing time. A satisfactory range is from —.03 to —.10 in. of water. If the pressure is positive in any





part of the setting it allows gas to discharge in the building, subjects refractory walls to a destructive soaking heat, and coats cracks and crevices in walls with soot, promoting failure. Investigate draft conditions carefully before considering firing methods or troubles caused by fine coal.

A survey with an accurate draft gage at various points plotted in sketch 1-C gives a clear picture of operating conditions. Take readings with boiler (1) banked or at minimum steam output (2) at maximum steam output and (3) at one intermediate point. At each rating adjust dampers or fan speed to give correct furnace-draft readings. If an orsat is available analyze the flue gas at each rating. If the maximum required rating cannot be obtained without a positive furnace pressure, additional induced draft is required.

Adjusting dampers to give furnace draft found by test to prevent blowback when firing is easier on equipment than starting and stopping the blower motor. Damper levers can be extended to boiler front and marked for quick setting at test point.

St. John, N. B. C G CLARK

Slow Blower Down

IF FORCED DRAFT causes flames to escape out the furnace door slow the blower down. If this can't be done, stop it while adding fuel. Gas comes out the door because combustion products travel the path of least resistance, whereas with natural draft, air at atmospheric pressure enters the door at the same pressure as that entering through the ashpit. Since the pressure is the same at these low points, and higher than it is in the stack, a draft is created which carries the gas out the stack without flames escaping from the door.

Philadelphia, Pa. W T MULLEN

Cover Fan Inlet

FIREMEN SHOULD NOT FIRE or bar the fire without first retarding the draft. I have witnessed severe injuries from failure to do this. It also causes excessive flyash.

Shutting the fan down completely allows excessive air to enter firedoors, permitting the coal to crust or cake, and may cause holes to be blown into the fire bed when the fan is again started. There is also the possibility of a gas explosion if the fire is covered.

The draft can be retarded in several ways. If the air inlet is convenient to the

(*Continued on page* 142)

Answers to April Question 2

How Do You Pack Valve Stems?

How often can the packing gland on a valve stem be tightened before installing new packing? Continued tightening stops leakage but it makes the valve difficult to operate and does in time wear the stem until it leaks continually. How does this affect regulating valve operation?

When adding so-called coil packing should you cut it into individual rings or can you wind it around the stem until the gland is filled? What material serves best for oil, steam or water, or can the same material be used for all three? I find it quite difficult to hold transil oil with the common varieties of stem packing. On several occasions the follower was broken by overtightening.—CS

Discard Hard Packing

FOR BEST RESULTS make a periodic check-up of all valves and equipment that require packing, and use the correct packing. When it feels hard to tighten, it is time to repack.

New additions to the packing family are designed to be used on high-temperature steam, oils and gases; also for expansion joints, furnace door grooves, locomotive-cab cocks, and many applications in oil refineries. This packing is braided from long-fiber Canadian asbestos yarn with the strands individually coated with a dry graphite for a good anti-friction wearing surface.

Many power plant men still insist on winding packing around the stem in one piece. This is definitely incorrect. Correct method is to cut individual rings and install them with alternate joints on opposite sides of the stem. Proper size of packing is important, although little trouble is experienced when larger sizes must be flattened slightly. Soft packings are suitable for scored stems. Metallic packing serves for highly superheated steam, has low friction ratio, and does not absorb water.

Manufacturers number different types of packing for pressure and service, and will gladly assist engineers in selecting the proper kind.

Rare indeed is the engineer who has never broken a gland follower or stripped the threads on a packing nut —this is all learned from practical experience.

If a mixture of graphite and cylinder oil is used to lubricate packing, apply it between each ring; this gives the packing a longer life and makes it easier to remove, especially if valves remain in service a long time.

Schedules for valve-packing jobs should be made up and followed diligently to save time, money and a lot of headaches.

Fairview, N. J. M N GOZDENOVICH

Describes Packing Punch

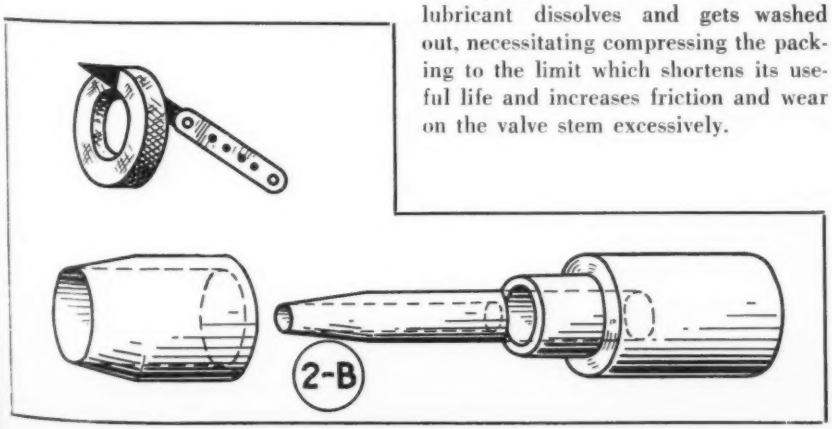
HOW TIGHT THE VALVE-STEM NUT can be taken up against packing depends on the kind of packing, depth of stuffing box, and kind of fluid, its pressure and physical and chemical effect on the packing material. Three turns is usually the maximum, with one turn a minimum. Tight packing on regulator valve stems causes sluggish operation.

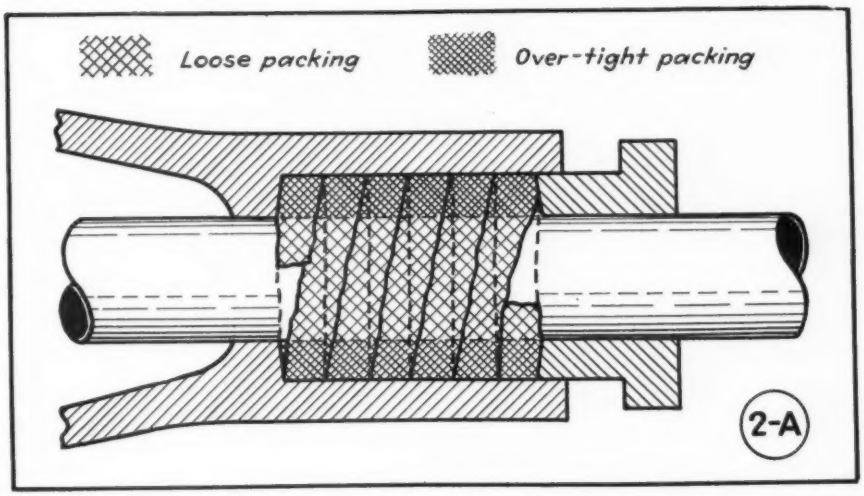
For small stems string packing may be wrapped spirally and pushed into the stuffing box in a mass. Packing for larger stems should be cut into individual rings. Material is most important. Although useful in ammonia or cold water valves, rubberized packing unless specially treated should not be used on steam, hot water, oil or many of the hydrocarbon fluids derived from oil or coal tar.

Washer-shaped packing rings which just fit the valve stem and stuffing box hold best of all. Standard sizes of these rings are available for valves, especially those in refrigerating systems. They may be punched out of suitable material with the 3-piece punch in sketch 2-B. If the valve wheel can be removed during repacking, leave the washers solid. If the wheel is not removed, split the rings at an angle to get them on the stem.

Any lathe operator can make hollow punches to fit valve stems and stuffing boxes of most valves about a plant. Then old rubber diaphragms of regulator valves, pieces of gasket and other scrap material can be turned into highly useful valve-stem packing with a few hammer blows.

Marissa, Ill. GEORGE HOLMAN





Advises Against Winding Packing In

CS NEEDS a general service packing impregnated with the right lubricant to protect the packing fibres. Manufacturers will lend every assistance. They are competent to provide a general-service packing for trouble-free service.

General-service packing for ordinary services performs equally well on either air, water, steam or oil. Inserted as individual rings, they pack with minimum pressure on the follower. Packed this way, they have low friction and do not wear the valve stem. If after a period of service the glands are tightened with reasonable force and the packing does not hold, it is usually necessary to repack the valve.

Tightening the gland nuts to the limit to prevent leaks, usually indicates that the packing lubricant is not suited for that particular service. This wrong lubricant dissolves and gets washed out, necessitating compressing the packing to the limit which shortens its useful life and increases friction and wear on the valve stem excessively.

Winding the packing around the stem until the gland is filled, produces the condition in sketch 2-A, which is similar to using a packing having the wrong lubricant, with the difference that the lubricant is not washed but squeezed out. One gland section is filled with loose fibers and another with fibers unduly compressed. To stop leakage through the loose fibers those already compressed must be compressed to the limit. This squeezes the lubricant from the fibers, and friction and wear on the valve stem increase accordingly. With the lubricant removed, the fibers deteriorate in a short time to a useless mass.

Philadelphia, Pa. EMIL WITTMAN

No Such Thing As All-Purpose Packing

IT IS OFTEN POSSIBLE to use one kind of valve-stem packing for various purposes but an all-purpose packing for general service could scarcely be expected. The life of a set of packing rings is affected by pressure, temperature, condition of valve stems and frequency of valve movement. The nature of the materials handled by the pipelines, as well as the differences in their temperatures, create demands which sometimes can be met only by some special grade of packing.

Fibrous packing impregnated with wax or grease compound might serve well on cold-water or other-temperature valves. But if the same packing were used on steam valves the filler materials would quickly melt away and the remaining portion become hardened.

Inasmuch as CS has difficulty in packing valves carrying transil oil, he may be using packing containing a high percentage of rubber, which is not adapted for that service. Under ordinary condi-

(*Continued on page* 142)

Q&A — QUESTIONS & ANSWERS FOR POWER ENGINEERS

By ALEX HIGGINS

15— *Fuel and Gas* (CONCLUDED) *Facts About Draft*

Fifteenth in a series that is running in every number of* POWER. *From long experience as a professional and practical engineer, Alex Higgins, of Calgary, Alberta, Canada, asks and answers questions regarding power equipment.

Q 1—What is a CO_2 recorder? Sketch and describe one type.

A—CO_2 recorder is an apparatus for automatically determining the percentage of CO_2 in flue gas and recording this analysis on a chart. One type is shown diagrammatically in Fig. 1.

A small stream of water passing through the aspirator draws a sample of flue gas into the measuring burette (4), and at the same time fills the standpipe containing the burette. When the water in the standpipe reaches the level marked *V*, a quantity of gas is trapped in the measuring burette. As the water continues to rise, the surplus gas passes off through the atmospheric tube until it is cut off at *W*, leaving an accurately measured sample of flue gas in the burette, under atmospheric pressure.

The water continues to rise in the standpipe, forcing the sample of gas over into the absorption chamber (9), which is filled with steel wool saturated with a caustic solution (*cardisorber*). As the gas comes in contact with the wet surfaces of the steel wool, the CO_2 is absorbed. At the same time some of the liquid in the absorption chamber is forced back into the caustic tank, raising the level of the liquid in the compression cylinder.

When the liquid level in the compression cylinder reaches *R*, the calibrating tube is sealed off, and any further rise of the liquid forces air into the bellows (14). The expansion of the bellows moves recording pen over chart a distance proportional to the amount of gas left in the sample after the CO_2 has been absorbed.

While this is going on, the water keeps rising in the standpipe until it reaches a level high enough to start the siphon flowing. The siphon then empties the standpipe. The pressure on the caustic in the absorption chamber being now released, the water rises to its original level in the absorption chamber, forcing the remainder of the gas sample back into the measuring burette. A stream of fresh flue gas sweeps through the burette, clearing out the old gas. Then the new sample is trapped, and the process is repeated. The flue gas is cleaned by bubbling it through water before it enters the recorder.

Q 2—Does a high percentage of CO_2 always indicate good combustion?

A—High percentage usually indicates that the excess air is being kept to the minimum, but it does not necessarily indicate the best attainable combustion, as there may also be a considerable percentage of CO. A mere 1% of CO may mean a loss of nearly 5% of the total heat value of the fuel burned. CO_2 should be high, with little or no CO.

Even when a CO_2 recorder is used gas should be checked periodically with an orsat to see whether CO is present.

(*Continued on page* 116)

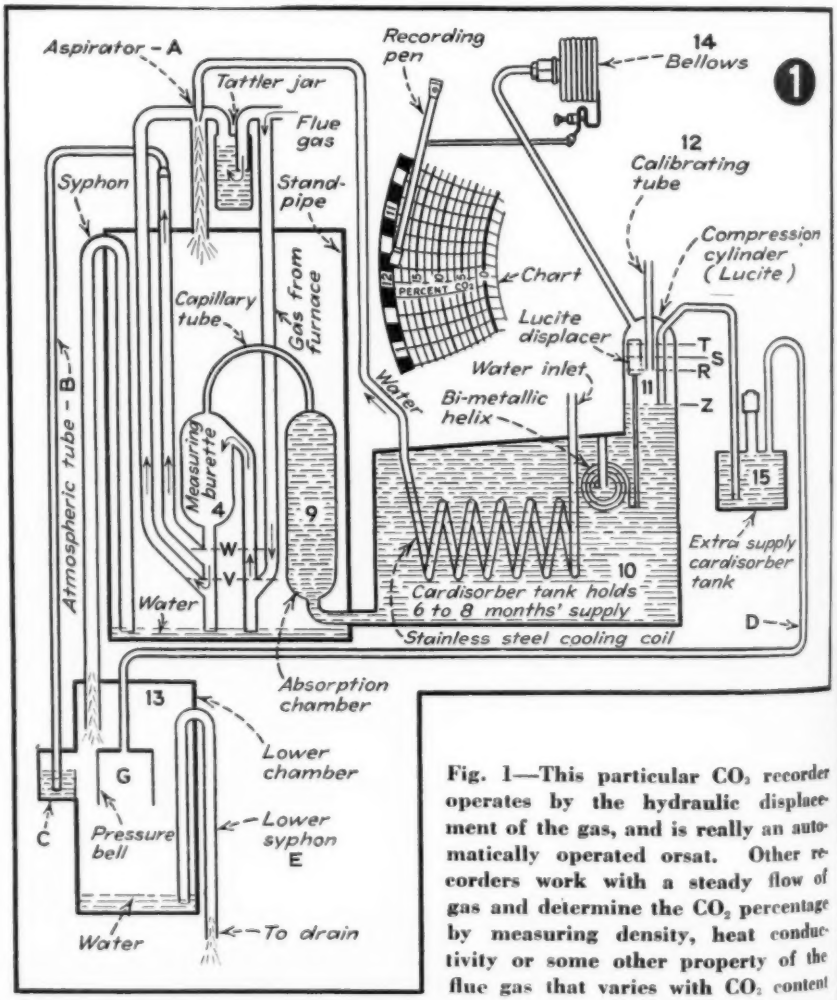
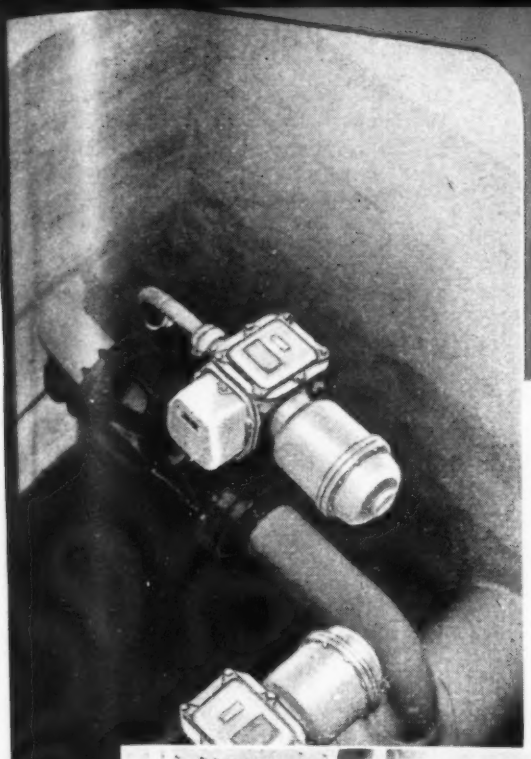


Fig. 1—This particular CO_2 recorder operates by the hydraulic displacement of the gas, and is really an automatically operated orsat. Other recorders work with a steady flow of gas and determine the CO_2 percentage by measuring density, heat conductivity or some other property of the flue gas that varies with CO_2 content

CUTLER-HAMMER

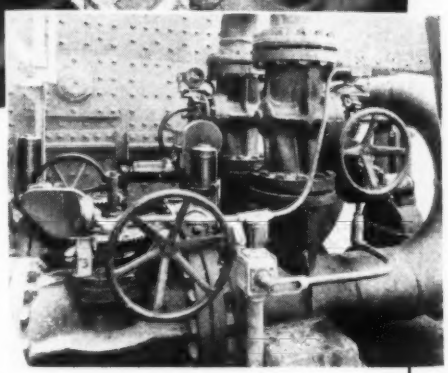
MOTORIZED VALVE OPERATORS



for better process control and plant operation . . .

Do you have valves too large, too hot, too "sticky," too hard to reach for efficient operation by hand? Do you need a simple, better or entirely automatic means of controlling valves in complex refining or chemical processes? Do you want instant operation of valves that are yards—or miles—apart? Do you want to conserve time and manpower in your plant? Or are you looking for valve control that not only *starts* any valve but will seat it safely with *positive protection to seat, gate, stem and mechanism?*

You will find what you want in the Cutler-Hammer Line of Motorized Valve Operators. You will find further, that in choosing Cutler-Hammer Valve Operators for the vast majority of installations, their purchasers are simply recognizing the overwhelming importance of dependability and superior engineering . . . the qualities that have always distinguished Cutler-Hammer design. CUTLER-HAMMER, Inc., 1209 St. Paul Avenue, Milwaukee 1, Wisconsin. *Associate:* Canadian Cutler-Hammer, Ltd., Toronto, Ont.

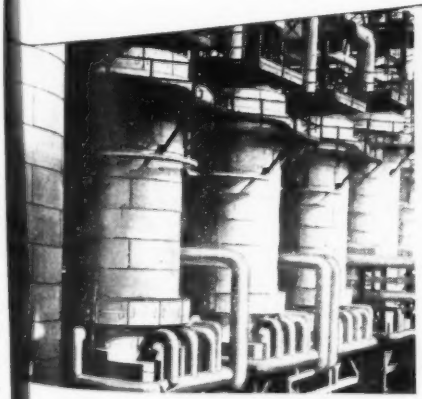


TO CUT BATCHES SHARPLY AND REDUCE CONTAMINATION IN PIPELINE OPERATION

212 Cutler-Hammer Valve Operators on the "Little Inch" pipeline from Texas to New Jersey, uncounted hundreds on other lines, indicate the importance of rapid, fully automatic and centralized control of valves in modern pipeline practice. It gives protection to product quality obtainable by no other means.

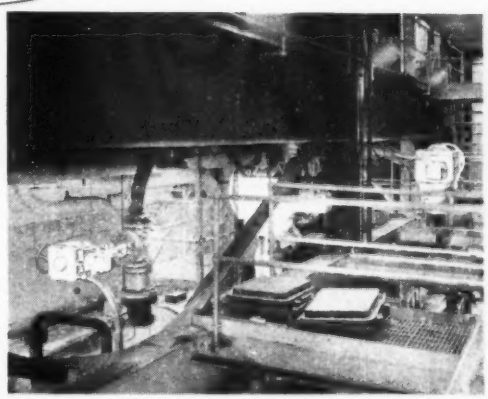
CUTLER-HAMMER
VALVE CONTROL
C-H

Milwaukee Plants



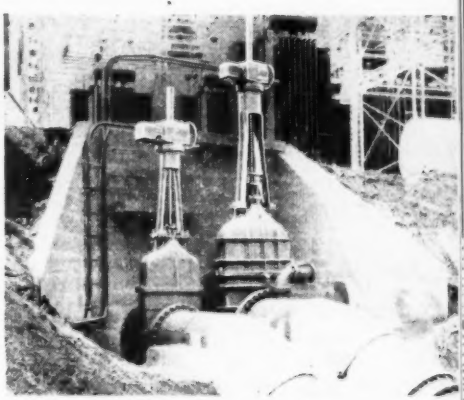
FOR SIMPLE, PRECISE CONTROL IN COMPLEX PROCESS INDUSTRIES

The widespread use of Cutler-Hammer Valve Control in high octane refining processes and other chemical process industries demonstrates the gains that result from fully automatic, often inter-locked sequence control of valves.



WHERE MEN CAN'T GO WHAT MEN CAN'T DO

High pressure, high temperature steam lines and valves often glow red . . . too hot to handle . . . too hard to turn. C-H controlled-thrust-seating operators operate these valves at the touch of a conveniently located push button . . . without danger of jamming.



TO OPERATE A VALVE IN THE NEXT COUNTY NOW

Distance means nothing to Cutler-Hammer Valve Control. The operation of any valve or any number of valves in the next room, on the next floor, or miles away is immediate, certain, easy . . . a matter of pushing a button located wherever convenience dictates.

Q&A FOR POWER ENGINEERS

(*Continued from page* 114)

Q 3—Give a formula for estimating the approximate heating value of a fuel from the ultimate analysis.

A—Dulong's formula, shown below, is probably the most widely used for this purpose. It is based on the known heat values of one pound each of pure carbon, pure hydrogen and pure sulphur. Each of these values is multiplied in turn by the percentage of that particular element in the fuel and the results added together.

In the formula, the heat value of one pound of hydrogen is taken as 62,000 Btu, the heat value of one pound of carbon as 14,600 Btu, and that of one pound of sulphur as 4000 Btu. It is assumed that all the oxygen shown in the analysis is already combined with one eighth its weight of hydrogen in the form of moisture and the hydrogen so combined is therefore incombustible. The symbols *C*, *H*, *O* and *S* represent the percentages of carbon, hydrogen, oxygen and sulphur. The formula is as follows:

Heat value per pound=

$$\frac{14{,}600\,C + 62{,}000\left(H - \frac{O}{8}\right) + 4000\,S}{100}\ \text{Btu}$$

Q 4—Give a formula for estimating the theoretical amount of air required for the complete combustion of one pound of fuel.

A—The following formula is based on the known amount of air required for the complete combustion of one pound each of pure carbon, pure hydrogen and pure sulphur. In the formula the figures represent this air in pounds, and the symbols are the percentages of carbon hydrogen, oxygen and sulphur.

Air required, pounds=

$$\frac{11.61\,C + 34.8\left(H - \frac{O}{8}\right) + 4.35\,S}{100}$$

Q 5—Calculate the heat value of a coal having the following ultimate analysis: carbon 82.4%; *hydrogen* 4.1%; *oxygen* 2.3%; *sulphur* 0.5%, *ash* 10.7%.

A—Using Dulong's formula:

Heat value =

$$\frac{14{,}600\times 82.4 + 62{,}000\left(4.1 - \frac{2.3}{8}\right) + 4000\times 0.5}{100}$$

$=146\times 82.4+620\times 3.81+40\times 0.5$

$=12{,}030+2364+20$

$=14{,}414$ *Btu—Answer*

Note that the heating value of the sulphur is negligible.

Q 6—Calculate the theoretical amount of air required for the complete combustion of the fuel of Question 5.

A—Air required =

$$\frac{11.61\times 82.4 + 34.8\left(4.1 - \frac{2.3}{8}\right) + 4.35\times 0.5}{100}$$

$$=\frac{11.61\times 82.4 + 34.8\times 3.81 + 4.35\times 0.5}{100}$$

$$=\frac{957 + 133 + 2}{100}$$

= 10.9 lb of air per lb coal.—Answer.

Q 7—When firing with coal describe the various steps in the combustion process from the time fresh coal is thrown on the fire.

A—(1) If the coal contains moisture, it is driven off. (2) The dry coal absorbs heat and the volatile constituents begin to distill off. (3) The volatiles mix with air and burn, their products of combustion passing up the chimney. (4) The fixed carbon left on the grate is now burned until only the ash remains.

Q 8—What furnace conditions are essential to burn coal efficiently and economically?

A—(1) Enough air must be admitted to supply the oxygen necessary for the complete combustion of the combustible elements of the fuel. (2) Admission of air must be regulated in such a way that it mixes thoroughly with the combustible gases distilled from the coal and comes in contact with all the carbon left on the grate after the gases are driven off and burned. (3) Temperature of the furnace must be kept at not less than 1800 F.

Natural and Mechanical Drafts

Q 9—What is draft?

A—Draft is the difference of pressure producing air flow through a boiler furnace, flue and chimney.

Q 10—Why is draft necessary?

A—It supplies air in sufficient *quantity* to insure complete combustion and under sufficient *pressure* to overcome the resistance offered by the boiler shell, tubes, furnace walls, baffles, dampers, breeching and chimney lining.

Q 11—In what units is draft measured?

A—It is measured in *inches of water column* as indicated by: (a) difference between the water-column heights in the two legs of a glass U-tube (b) height of the column in an inclined-glass draft gage (c) pointer reading in an indicating or recording draft gage.

Q 12—How is draft measurement in inches of water converted into pressure in pounds or ounces per square inch?

A—Weight of a cubic foot of water varies with temperature, being 62.43 lb at the point of maximum density, 39.2 F. Drop in weight is very slight over the ordinary range of boiler-room temperatures so for all practical purposes take it as 62.4 lb per cu ft.

(*Continued on page* 118)

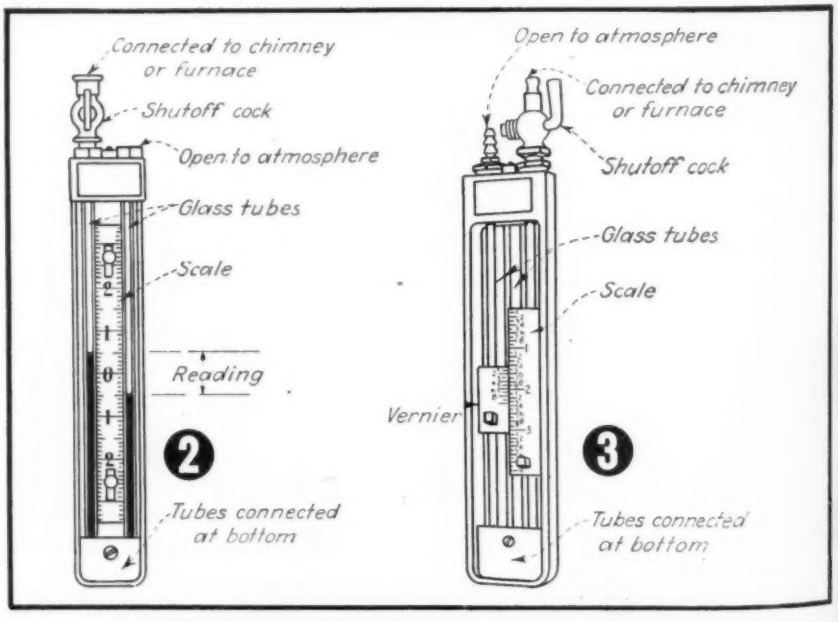


Fig. 2—Simple U-tube draft gage measures pressure differences as inches of water. Fig. 3—U-tube draft gage with vernier reads to hundredths of inch

Yarway Impulse Traps

For Pressures Up to 1500 lbs

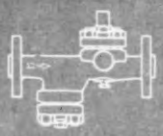


Fig. No. 140 to 147. Medium pressure integral-strainer Impulse Trap for pressures up to 600 lb. Steel body, flanged connections.

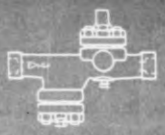


Fig. No. 250 to 257. Medium pressure integral-strainer Impulse Trap for pressures up to 600 lb. Steel body, socket weld connections.

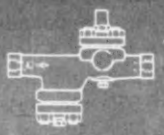


Fig. No. 410 to 417. Low pressure integral-strainer Impulse Trap for pressures up to 150 lb. Bronze body, screwed connections.

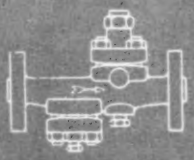
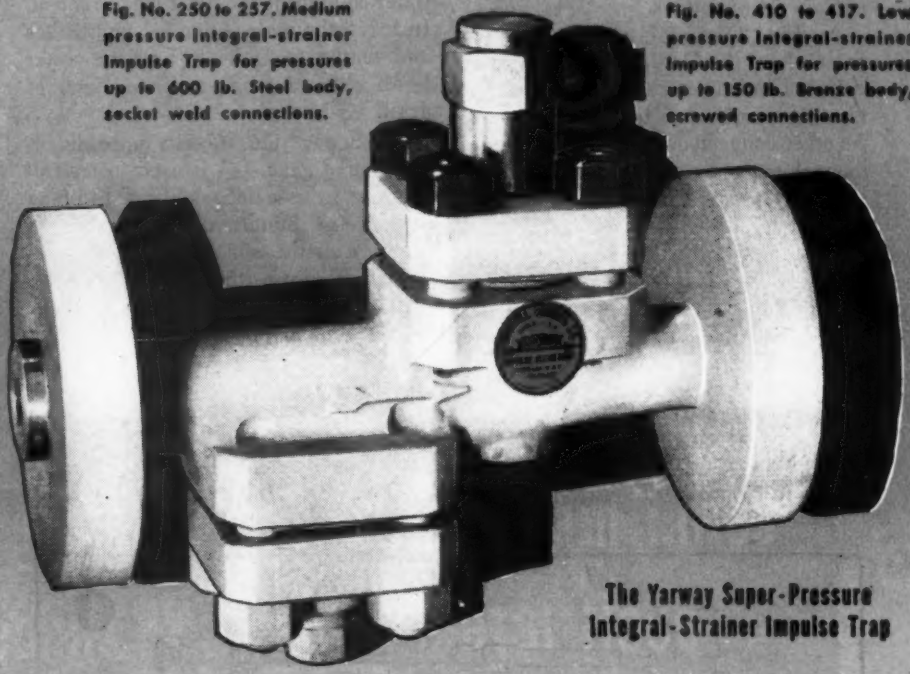
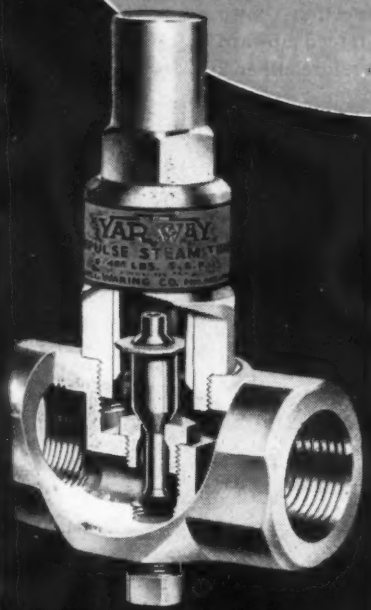


Fig. No. 150 to 157. Super-pressure integral-strainer Impulse Trap for pressures up to 1500 lb. Steel body, flanged connections.



The Yarway Super-Pressure Integral-Strainer Impulse Trap



The Standard Yarway Impulse Trap. Note only one moving part — a little valve.

ALONG with the remarkable success of the YARWAY IMPULSE TRAP for standard trapping service (more than 250,000 have been purchased), has come its use in steam plants where pressures as high as 1500 lbs and temperatures as great as 900°F are encountered.

The integral-strainer trap shown above, developed for this service is suitable for every drainage requirement in high pressure steam installations. It has ample condensate capacity when system is being "warmed up". It will handle relatively small amounts of high temperature condensate, efficiently, without losing its prime.

The valve closes positively in the presence of dry or superheated steam.

It is a fraction of the size and weight of other type traps designed for the same service—saving space, simplifying installation and requiring no support.

It is suitable for all pressures within a wide range without change of valve or seat.

It has the same simplicity of design as does the standard Impulse Trap—only one moving part, a little valve.

Its integral-strainer protects the trap against scale and rust in the system.

For complete description of operating principle, send for Bulletin T-1738.

YARNALL-WARING COMPANY, 100 MERMAID AVE., PHILADELPHIA 18, PA.

YARWAY IMPULSE STEAM TRAP

Q&A FOR POWER ENGINEERS

(*Continued from page* 116)

One cu ft equals 1728 cu in. Dividing 62.4 by 1728 gives 0.036 psi, the pressure in pounds per square inch indicated by a column of water 1 in. high. This number multiplied by 16 gives 0.576, the pressure in ounces per sq in.

Q 13—Sketch a U-tube draft gage, and explain its operation.

A—Fig. 2, page 116, illustrates the principle of the U-tube draft gage (also called a manometer). One end of the glass U-tube is open to the atmosphere, the other connected to the boiler furnace, flue, chimney or other inclosed space where it is desired to measure draft pressure. The U-tube is partly filled with water and, when there is no difference in the pressure acting upon the water surface in the two legs, water level is the same in each leg and the reading on the scale zero.

If the pressure within the boiler setting or chimney is *greater* than the atmospheric pressure it forces the water down in the leg connected to the setting, and up a corresponding amount in the leg open to the atmosphere. If the pressure within the boiler setting is *less* than the atmospheric pressure, the latter forces the water down in the leg open to the atmosphere and up in the leg connected to the setting. Difference in inches between the levels of the two water columns is the draft measurement. In Fig. 2 the scale is divided into inches and tenths of an inch, and the water levels show a reading of one inch of draft.

Fig. 3, page 116, shows a more elaborate U-tube gage. Oil is used instead of water and the scale is calibrated to read directly in hundredths of inches of water, with the aid of a vernier. Connected as shown, the scale reads pressure above atmospheric. Suction can be read by changing the top connections.

When taking a reading on this, or any other instrument where the water level in a tube must be read, note that the water surface is not flat, but concave. The curvature is caused by surface tension, and the shape assumed by the water is called a *meniscus*. The same phenomenon is observed with lighter liquids, such as oils, but when mercury is used the meniscus is reversed, or convex. The bottom of the meniscus is usually read on the scale when water or oil is used and the top when mercury is used.

Q 14—Sketch an inclined-tube draft gage and explain its operation.

A—This gage is the same in principle as the U-tube, but one leg is inclined, Fig. 4, and a liquid is used that will not evaporate so readily as water. As the liquid moves through a considerable distance in the inclined tube for a very small change in vertical height, a much larger scale can be used than that in the vertical tube gage so that readings are much finer. Gage scale in Fig. 4 is registering pressure below atmospheric pressure, the reading being 0.25 inch of draft. Here, the furnace pressure is below atmospheric and the atmospheric pressure is forcing the liquid down in the inclined tube.

With chimney draft alone, or with chimney plus induced-draft fan alone, the furnace pressure is always less than atmospheric. If a forced draft fan is added, pressure in the furnace may be greater or less than atmospheric or equal to it, that is, balanced. If furnace pressure is higher than atmospheric the connection shown causes the liquid to be forced upward in the inclined tube. Therefore either the scale or the connection must be reversed.

Q 15—Sketch and describe a diaphragm-operated draft gage.

A—Fig. 5 shows the operating principle of this gage. A thin diaphragm of very flexible material is inclosed in a metal case and connected through suitable links or gearing to a pointer that moves over a scale graduated to read in

(*Continued on page* 156)

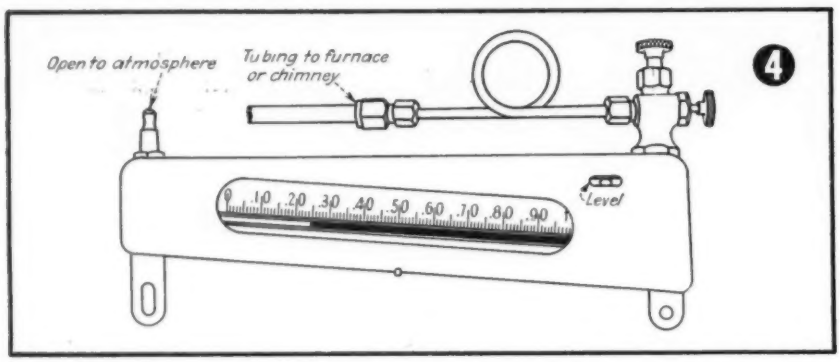


Fig. 4—Inclined-tube draft gage increases column movement for easy reading

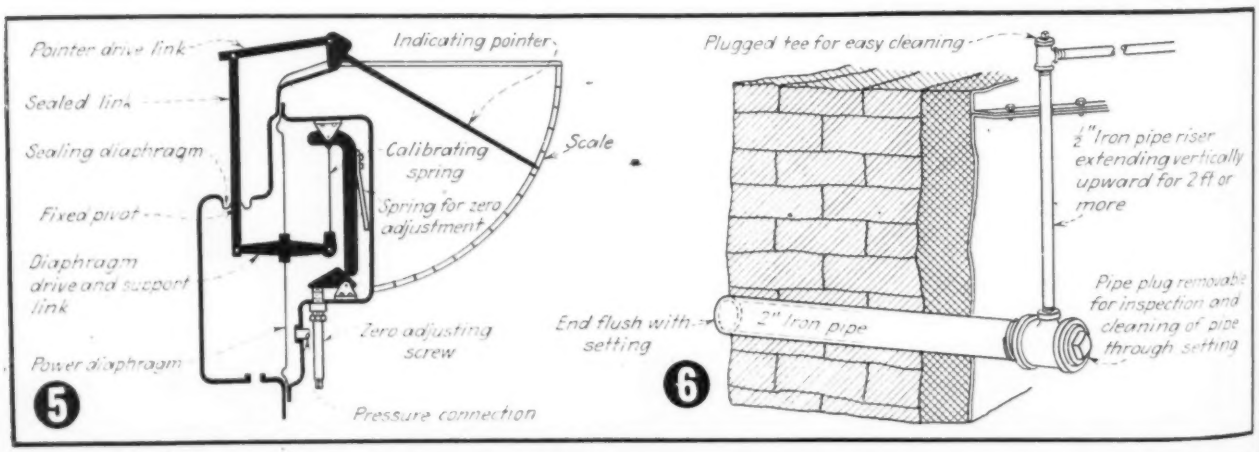
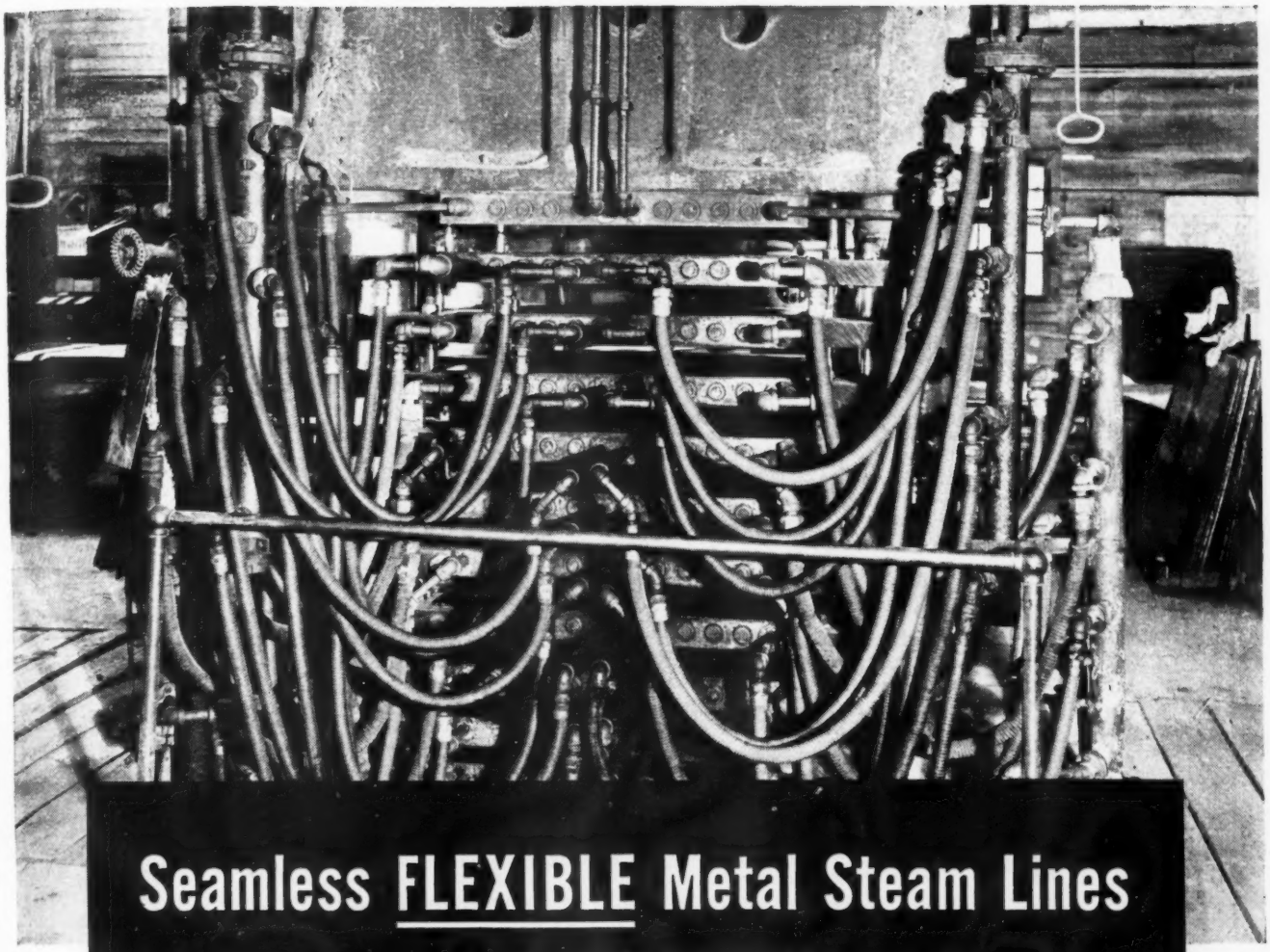


Fig. 5—Diagrammatic sketch of diaphragm-operated draft gage. **Fig. 6—Draft gage connection to boiler furnace**



Seamless FLEXIBLE Metal Steam Lines Encased in FLEXIBLE Metal Hose

Undamaged after 7 years service

THIS PRESS for molding fiber sheets presented an unusually difficult problem in supplying steam to a multiplicity of moving parts.

Today, after seven years of heavy production without steam line failure, this manufacturer congratulates himself on having followed the advice of our Technical Department before setting up this press.

American Seamless Flexible Metal Tubing was selected for the steam lines. To meet the problem of friction or abrasion, the Seamless Tubing was encased in flexible, wear resistant American Interlocked Bronze Hose. Couplings are of brass, threaded for iron pipe connections.

If you have a problem involving the conveying of steam, air, water, oil or fuel, loading or discharging any material that will flow through a pipe, connecting moving parts or misaligned parts, isolating vibration or shielding electric wiring where the line must be flexible or resistant to abrasion, perhaps our Technical Department can be of assistance to you. Complete descriptive literature is available on request. 44196

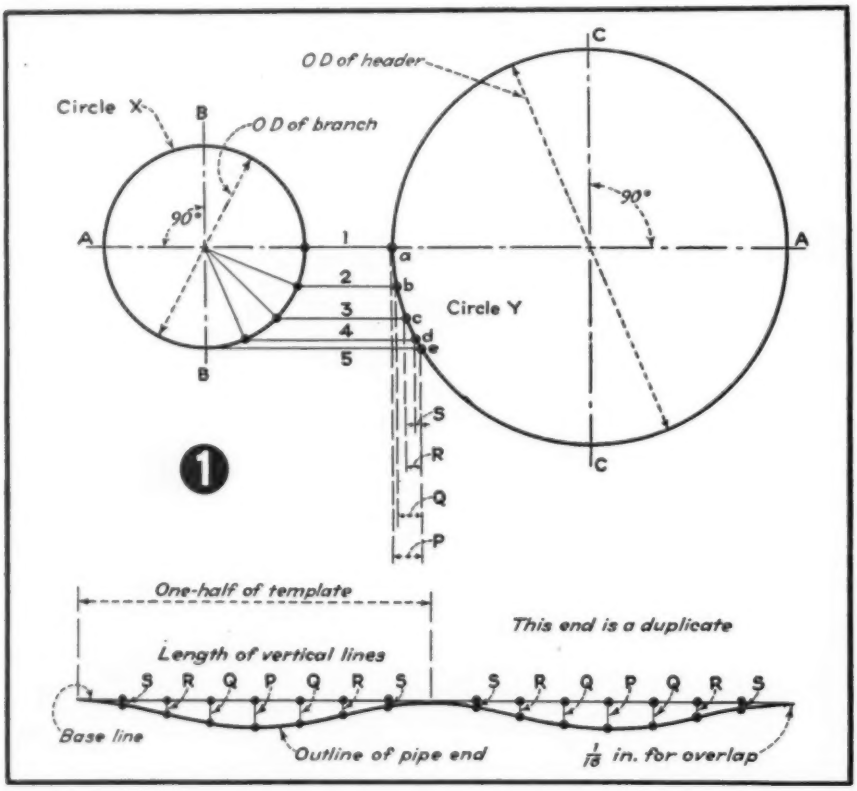
ANACONDA *American Metal Hose*

AMERICAN METAL HOSE BRANCH OF THE AMERICAN BRASS COMPANY • General Offices: Waterbury 88, Conn.
Subsidiary of Anaconda Copper Mining Company • *In Canada:* ANACONDA AMERICAN BRASS LTD., *New Toronto, Ontario*

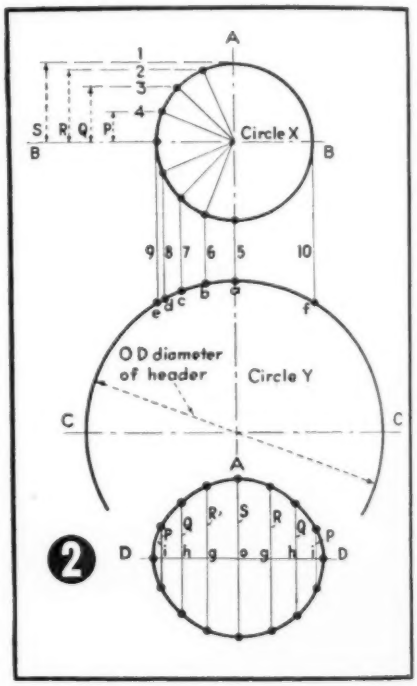
HOW TO LAY OUT PATTERNS FOR PIPE FITTINGS

HEADER BRANCH LINES can be laid out accurately with patterns, or templates, for cutting a hole in the header and trimming the pipe end. Make templates from heavy manila drafting paper; if they are to be used repeatedly, keep the original as a master to mark duplicate copies when old ones wear out from constant use. Thin fiber makes sturdy working templates.

When a large number of pipe fittings are to be fabricated some welders cut their master templates from light gage sheet steel. A series of templates designed to fit main headers throughout the plant speed up the work when a branch line must be connected in a crowded location during short outage.



Courtesy,
The Linde Air Products Co



1 To prepare a template for trimming the branch end, lay out center lines *A-A*, *B-B* and *C-C*. At intersection of *A-A* and *B-B* draw circle *X* equal to outside diameter of branch. At intersection of *A-A* and *C-C* draw circle *Y* equal to outside diameter of header.

In lower right-hand quarter of circle *X*, draw three radii 22½ deg apart dividing the quarter circle into four equal parts. Draw horizontal lines 1, 2, 3, 4 and 5 (parallel to *A-A*) to circle *Y* and mark intersections *a*, *b*, *c*, *d* and *e*. From these latter points draw five lines parallel with *C-C* and measure distances, P, Q, R and S.

Lay out a baseline equal to the outside circumference of branch, plus 1/16 in. for overlap when wrapping template around pipe. Mark this line off into 16 equal divisions, not including the overlap, and drop a vertical line from each division. Make vertical lines to lengths *P*, *Q*, *R* and *S* measured on circle *Y* and draw smooth curve from end of baseline through the terminal dots. Right-hand end of baseline is a duplicate of the left-hand, as shown in sketch.

2 To prepare a template for cutting hole in the header, lay out center lines *A-A* and *B-B*. At their intersection draw circle *X* equal to outside diameter of branch. On center line *A-A* also draw circle *Y* equal to outside diameter of header.

In the upper left-hand quarter of circle *X* draw three radii 22½ deg apart to divide the quadrant into four equal parts. From these points draw lines 1, 2, 3 and 4 parallel with center line *B-B*. Also divide the lower left-hand quarter into four equal parts and drop vertical lines 5, 6, 7, 8, 9 and 10 (parallel to center line *A-A*) to intersect circle *Y*.

Lay out baseline *D-D* equal in length to the arc distance from *e* to *f*. Take this measurement with a flexible steel tape. Make *o* the center point of base line *D-D*. On either side of *o* locate points *g* and *g* so that distances *o-g* are equal to *a-b* on circle *Y*. Make distance *g-h* and *h-i* equal to *b-c* and *c-d* respectively. Then draw vertical lines from these points perpendicular to baseline *D-D* and equal in length to the distance *P*, *Q*, *R*, and *S* at upper left-hand quadrant of circle *X*. Lay out lower half of oval in a similar manner. Cut the paper along the oval-shaped outline and the template is ready to be laid on the pipe.

(*Continued on page* 122)

HOW THE MAILMAN...

NALCO SYSTEM SERVICE REPORT CARD

FIRM _____

ADDRESS Cleveland Ohio.

DATE	H	P	M	Na Cl	Na_2SO_4	DS	PO_4	LBS. NALCO		GALLONS OF WATER TREATED
3-6	0.0	15.2	21.6	23.0	25.5	79.5		21		25,600
3-7	0.0	16.1	22.0	25.0			•	18		21,350
3-8	0.0	21.6	28.0	28.5	32.5	98.0		24		27,480
3-9	0.0	22.4	30.6	27.0				24		22,800
3-10	0.0	17.3	23.1	25.5	28.0	89.0		21		24,600
3-11	0.0	14.8	19.3	24.8				24		26,500

Raw Water H 7.8, G. P. 5.4, M. 5.2, CO_2 _____ Na Cl. 1.9 Clear or Muddy? clear

Quality of Steam Dry Condition of Boilers good Coagulation good

Blowdown Interval Continuous - plus - one hand blow per 24 hrs

Remarks:

Signed John Smith.

Form 76-1 10M 11-43 w

HELPS SAVE COAL...

You have command of the services of what are considered to be the world's finest water treatment laboratories when you use Nalco Water Treatment Service.

According to one authority, 1/10" scale on a boiler tube will cause heat losses as high as 16%, with consequent serious waste of critical coal. If your water treatment is correct, you won't have any scale. *But how do you know it is correct?* Conditions change.

Supplementing the Nalco personal field service system, you *mail* reports to the Nalco Laboratories, from which they can tell if there is any change within your boiler which might cause operating difficulties. They tell you or show you what to do about it *before the damage is done.*

It's simple, easy and takes but a few minutes, and then you *know* how to control your water treatment, blow-down and other factors to prevent scale and carryover, save coal, and maintain peak boiler efficiency. To eliminate guesswork, write to Nalco today for a survey of your plant.

nalco

... the complete water treating service

NATIONAL ALUMINATE CORPORATION

6222 West 66th Place • Chicago, 38, Ill.

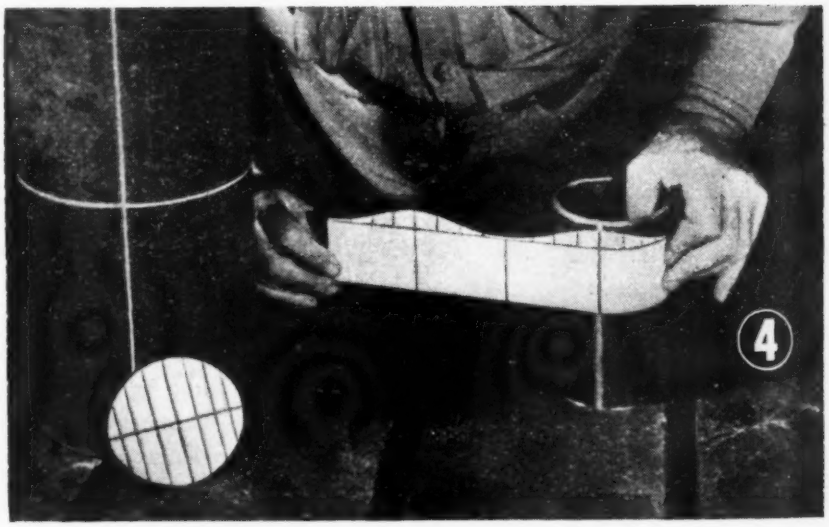
Canadian inquiries should be addressed to Aluminate Chemicals, Ltd., 555 Eastern Avenue, Toronto, Ontario

HOW TO

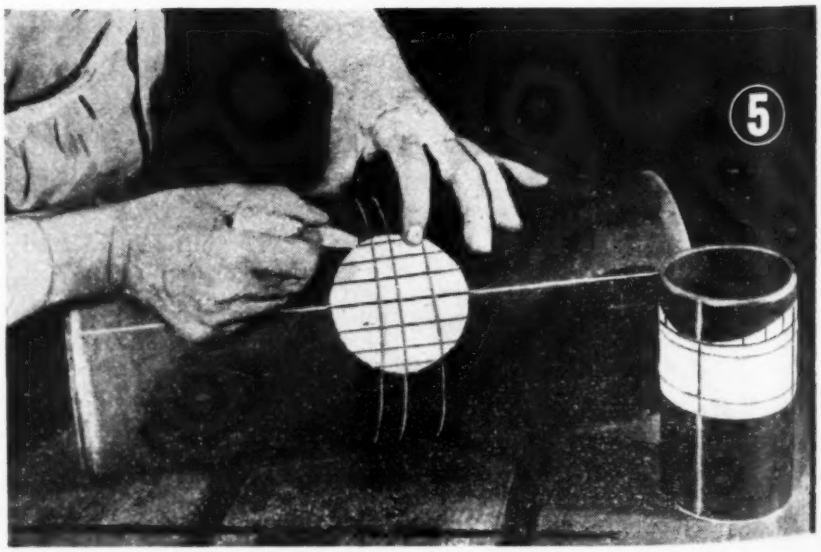
LAY OUT PATTERNS FOR PIPE FITTINGS

(*Continued from page* 120)

3 To apply these templates to pipe accurately, establish circumferential and longitudinal reference lines, at right angles to each other, on both the header and branch. An easy way to establish the longitudinal line is to place a length of channel iron against the pipe and make a soapstone mark along one channel edge. Be sure that pipe is clean of rust and scale and that channel iron fits against pipe snugly. Circumferential line can be made by wrapping a squared piece of paper around the pipe and marking along one edge (photo).



4 Wrap the long template around branch end (photo) making sure that longest vertical line on template coincides with reference line on pipe. Hold it in place with rubber bands and mark the pipe with soapstone along the template's curved edge. Center-punch the soapstone mark so that heat from cutting flame does not obliterate guide line. Cutting the pipe along this wavy line prepares it for welding. It is not necessary to bevel pipe end.



5 Apply the smaller oval-shaped template to the header with rubber bands or string in such manner that short axis of template coincides with longitudinal reference line and its long axis coincides with circumferential line on pipe. Mark around edge of template with soapstone (photo) and center-punch the line.

Editor's note: Welding fittings are available that make sturdier connections than pipe-to-pipe branch welding. They also keep the branch line from extending into header flow and make a stronger header joint.

Edward
GAGE VALVES

FOR services where bar stock valves are often used—gage, meter, dead end and instrument lines, pump vents and Diesel and gas engines—Edward Fig. 152 gage valves have the advantage of much greater strength.

Because they are drop forged steel, the bodies of Edward gage valves have sounder structure and greater strength than bodies machined from a bar. For non-shock service up to 4000 lb at 150 F and in steam service up to 600 lb at 750 F. Made to customary Edward precision and quality standards, yet remarkably low in price because of production runs.

DESIGN DETAILS

Rugged, functional design qualifies Edward Fig. 152 gage valves for long life in tough service. Notice exclusive safety taper threaded bonnet joint, EValloy stainless steel stem with semi-needle disk, knobbed handwheel for easy grip and leverage, back seating shoulder to prevent backing stem out of bonnet and to permit repacking under pressure. Bonnets and packing nuts are EValized to cut corrosion and wear.

DIMENSIONS AND RATINGS

4000 lb at 150 F

600 lb at 750 F — 475 lb at 1000 F

DIMENSIONAL DETAILS

SIZE	1/8"	1/4"	3/8"	1/2"
End to end—Globe	1 13/16	1 13/16	2 1/4	2 3/4
Center to end—Angle	29/32	29/32	1 1/8	1 3/8
Center to top—Open	3 5/8	3 5/8	3 7/8	4
Port diameter	1/8	3/16	1/4	3/8
Weight—lb	1	1	1 1/4	1 1/2

For illustrations, dimensions and descriptions of the Edward line of cast and forged steel valves write for a free copy of the new Edward BETTER VALVES Catalog No. 102.

THE EDWARD VALVE & MFG. CO., INC., • EAST CHICAGO, INDIANA

EDWARD *Steel* VALVES

ARGUMENT CORNER

Wire Wrapping Repairs Heater Coil

I HAVE READ A H Parker's article, page 106, March POWER, on his trouble with copper coils in a water heater and suggest the following repair:

Remove the clamp and taps and thoroughly clean the copper pipe with emery cloth. Apply a soldering acid, or flux, over the cleaned section, which should extend at least 1 in. each side of the fault. Beginning at about 1 in. beyond the fault, wrap the pipe with No. 14 or No. 16 cleaned copper wire, to 1 in. beyond the other end of the defect.

Securely fasten each end of the wire to keep the wrapping tight on the pipe. Apply soldering acid or flux to the wire and with a small blow torch thoroughly solder wire ends together and to the pipe. This method when properly applied makes a good repair to the defect or to any other weak spot to prevent future trouble.

If the copper pipe is too far gone for this type of repair, brass pipe is preferable to galvanized iron for coils in hot-water service. This pipe probably can be obtained now because conditions regarding brass have improved recently. I believe, however, that with steam pressure reduced to 5 psi and water to 30 there should be no difficulty in making a repair of the old pipe in the way I have described.

Ansonia, Conn. WILLIAM T ESTLICH

Water Column Connections

IN THE DEC "ARGUMENT CORNER," Chas S. Paulson, Tacoma, Wash., objected to valves on water columns, and would omit them in Alex Higgins' design in POWER, Oct. 1943, page 118. While Mr Paulson has several good points, I see no advantage in omitting these valves and in having no self-closing automatic gage-glass valves on water column. He states that valves had no care in 15 years, and should not be put in a line where they would be neglected and never used. While his State may prefer connections to water columns with no valves, I think most States would allow valves here.

By shutting off main steam and water valve to column, repairs can be made quickly when needed because of faulty operation of high- or low-water alarm, leaky try cocks, leaky shutoff connections to gage glass, or accidental breaking of drain valves or try cocks on water column. With automatic water-level regulators on boiler this should not be difficult as the automatic will hold the proper water level.

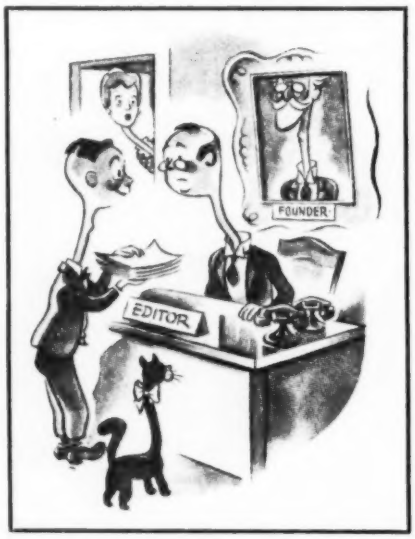
Poor quality gage glasses are fickle things, easily affected by drying out of rubber rings, unequal tightening of packing nuts and by glass ends wearing down to paper thickness. These don't reassure the fireman, especially if he doesn't know how long the glass has been in the column. Cross tees should be placed at boiler drum and water column, so that once a year (or oftener) a rod can be shoved through piping to make sure all connections are clear.

No scale or mud should accumulate in water-line fittings of water column if it is blown down once on each shift and if boiler-water concentration is not too high. Take off bonnets of water column valves at least once a year and clean valves. Never use globe valves with composition disks. Use nothing but rising gate valves of a reliable make, so the fireman can tell at a glance whether valves are open or closed, or have been tampered with.

Provide for locking them if chief engineer sees fit. Don't think there is any danger that these valves will be shut at wrong time; any qualified fireman or engineer understands the danger of tampering with them and will not permit them to be touched except by a responsible person. While the Higgins' plan may look top heavy on paper, on the actual job it would be in proper proportion to the boiler.

W J Cadman, Cincinnati, Ohio, also voices his objections to the position of the rising-spindle valves, which are upright, as they should be. He wants them upside down, which would be objectionable because bonnets would accumulate mud and scale until valves became inoperative. Valve manufacturers always stress this point: Never put a valve upside down unless its bonnet is fitted with a drain. Need I say more?

Ottawa, Ont., Canada
JOSEPH BONGIORNO



This department is devoted to readers who enjoy, as we do, sticking their necks out. We could be editorial turtles, safely reporting developments month to month, but it's a lot more fun to see what's going on. Incidentally, we're looking for a man familiar with writing and power engineering to join our necks-out club—among other things to handle this page.

Silver Solder Helps Remove Broken Stud

THE ARTICLE on removing broken studs, by D A Burma, Feb, 1944, POWER brings to mind my experience in removing a brass stud from a pump suction-valve seat. This stud resisted all efforts to remove it until we hit upon the following use of the electric welder.

We removed the carbon electrodes from two old flashlight batteries and ground their bottom ends to a long point. We left the metal cap in place on the top end for connection in the arc-welding electrodes holder. Setting the welding machine for 125 amp we drew an arc several times on a piece of casting to burn the impurities out of the carbons and then pointed them again when they had cooled.

The stud projected a short distance above the valve seat so we reamed out a brass nut and fitted it over the stud end, first coating the stud and inside of

(*Continued on page* 150)

Shutout FOR DIESEL SHUTDOWNS

SOLNUS OILS

make possible 7000-hour continuous runs . . . 35% saving

Not all diesels have to make 7000-hour continuous runs like the one in this ice plant where unscheduled shutdowns mean serious interruptions to production. But all diesel operators can learn a lesson in lubrication from this user's experience.

Forced shutdowns twice a year used to be the rule . . . were caused by excessive carbon formation and ring wear. Oil had to be added to the system every week. Monthly consumption averaged 60-70 gallons. Finally a Sun Engineer was asked for advice and he recommended Sun Solnus Oils.

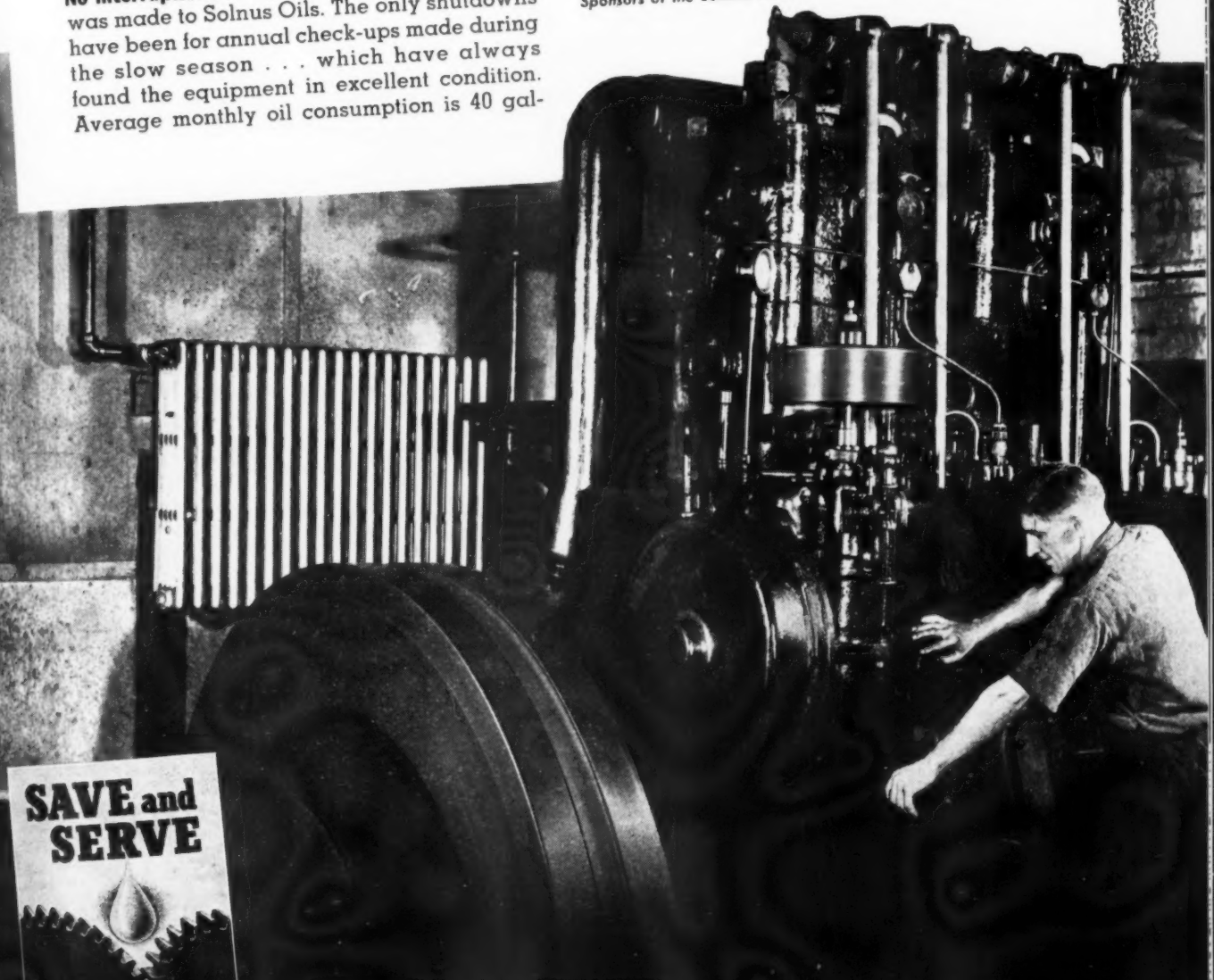
No interruptions in 6 years . . . after the change was made to Solnus Oils. The only shutdowns have been for annual check-ups made during the slow season . . . which have always found the equipment in excellent condition. Average monthly oil consumption is 40 gallons — a 35% saving. Just another typical example of correct Sun lubrication!

SUN'S "SAVE AND SERVE" PLAN

Equipment . . . time . . . labor — can all be saved with proper lubrication. Sun has the plan that makes it possible . . . including lubrication manuals, technical and maintenance bulletins, wall charts, posters, performance folders, etc. For folder giving full details of this free plan, write . . .

SUN OIL COMPANY · Philadelphia 3, Pa.

Sponsors of the Sunoco News Voice of the Air — Lowell Thomas



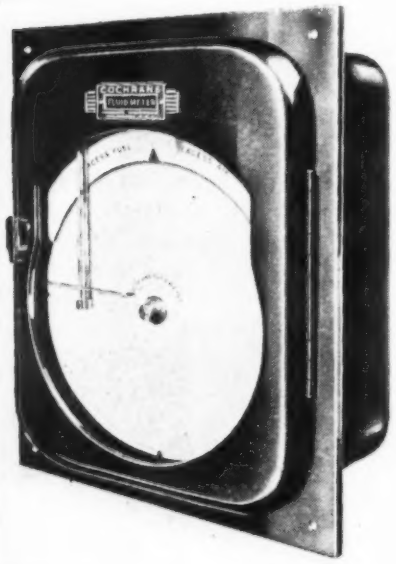
SUN INDUSTRIAL PRODUCTS

HELPING INDUSTRY HELP AMERICA

WHAT'S NEW IN PLANT EQUIPMENT

Boiler Meter

COCHRANE BOILER RATIO METER has the following advantages, according to manufacturer: (1) Operator can establish relation of air to fuel supply (measured by steam generated) most favorable to his particular operation by an easily adjustable cam in air-flow mechanism. (2) Red-indicating pointer operating across a white 10-in. scale provides quick and easy reading, making it



unnecessary to examine closely pen positions to determine whether air is excessive or insufficient, as pointer movement is three times as great as differences between pens. (3) Steam-flow mechanism is that of the standard Cochrane friction-free electric flowmeter, operating on null balance principle, assuring highest accuracy. (4) Air-flow mechanism is based on the Hays slack diaphragm, equipped with an electric motor follow-up for ample power. *Cochrane Corp, Philadelphia* 32, *Pa.*

Welding Alloys

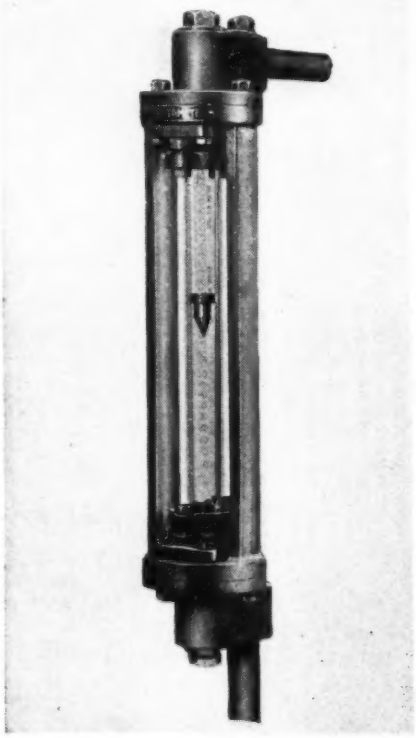
SEVERAL NEW ALLOYS are claimed to offer all advantages of silver solders, yet contain little or no silver. They are said to have greater strength, firmer bonds and greater hardness than silver solders. New welding alloys are not, however, primarily designed as substitutes for silver solders. They may do many jobs that cannot be done by any of the common soldering alloys. Available in wires, strips, sheets and rods, and some in fine powder form, application principles are similar to those of brazing in preparation, fluxing and heating.

A few of the alloys that are now being offered are: Eutectic alloy rods No. 18, 145, 180 and 800, having tensile strengths up to 57,000 psi and binding temperatures from 1290 to 1600 F, for brass, bronze and copper. Alloy rods No. 16, 18 and 145, having tensile strengths up to 117,000 psi, for steel. Rod No. 20, which has an approximate tensile strength of 95,000 psi and binds at 1290 to 1600 F, for nickel and nickel alloys. Remelting temperature is 1800 F. *Eutetic Welding Alloy Co.*, 40 *Worth St. New York, N. Y.*

Conveyor Elevator System

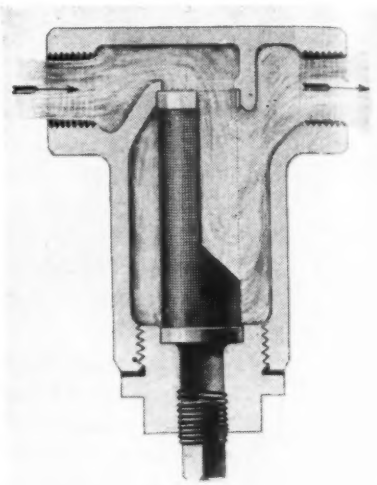
REX UNI-FLO is a continuous-stream conveying unit for mass handling of free-flowing bulk materials. It is composed of a chain-belt-equipped closely spaced scraper-carrier flight, which operates in an inclosed casing. With entire cross section of casing and all space between flights solidly filled with material being handled, a continuous flow of material results. A positive and unique discharge mechanism removes all material at discharge point.

It is completely self-feeding and requires no auxiliary feeding devices. Rex Uni-Flo is also self-cleaning and has a minimum of churning and degradation of materials while in operation or after the feeding has stopped. It operates at relatively slow speeds. *Chain Belt Co, Milwaukee, Wis.*



Universal Rotameter

SK UNIVERSAL ROTAMETER is said to accurately indicate liquid- or gas-flow rate in a pipeline. One-piece frame construction, similar to that of previous models, has been retained and new end castings allow for 25 different piping hookups. Inside of tube may be cleaned without removal and tube assembly withdrawn without disturbing pipe connections. *Schutte & Koerting Co, 12th and Thompson St, Philadelphia* 22, *Pa.*



Liquid Strainers

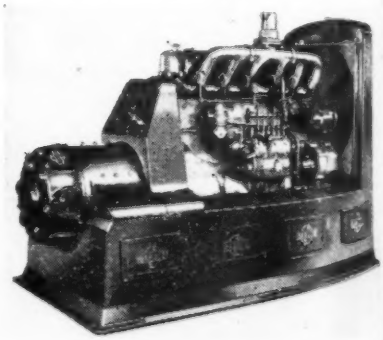
FOR INSTALLING several nozzles on a single feed line, *TW* strainer, as shown, is claimed to offer unique advantages:

(1) Strainer design results in an extremely large open screen area in relation to the pipe area. (2) *TW* permits freer liquid flow and does not require cleaning as often as ordinary strainers. (3) Blowout plug makes strainer easy to flush and clean without removal from line. (4) Standard *TW* is supplied with cast-iron body and brass wire screen; all brass, or all stainless-steel construction, is also available. (5) Choice of screen mesh is offered so that strainer performance may be directly related to nozzle orifice size. *Q* line strainer is for single-nozzle installation. Maximum strainer capacity is 1 gal per min of water, brine, oil and liquids of similar viscosity. *Spraying Systems Co*, 4021-*S W Lake St, Chicago, Ill.*

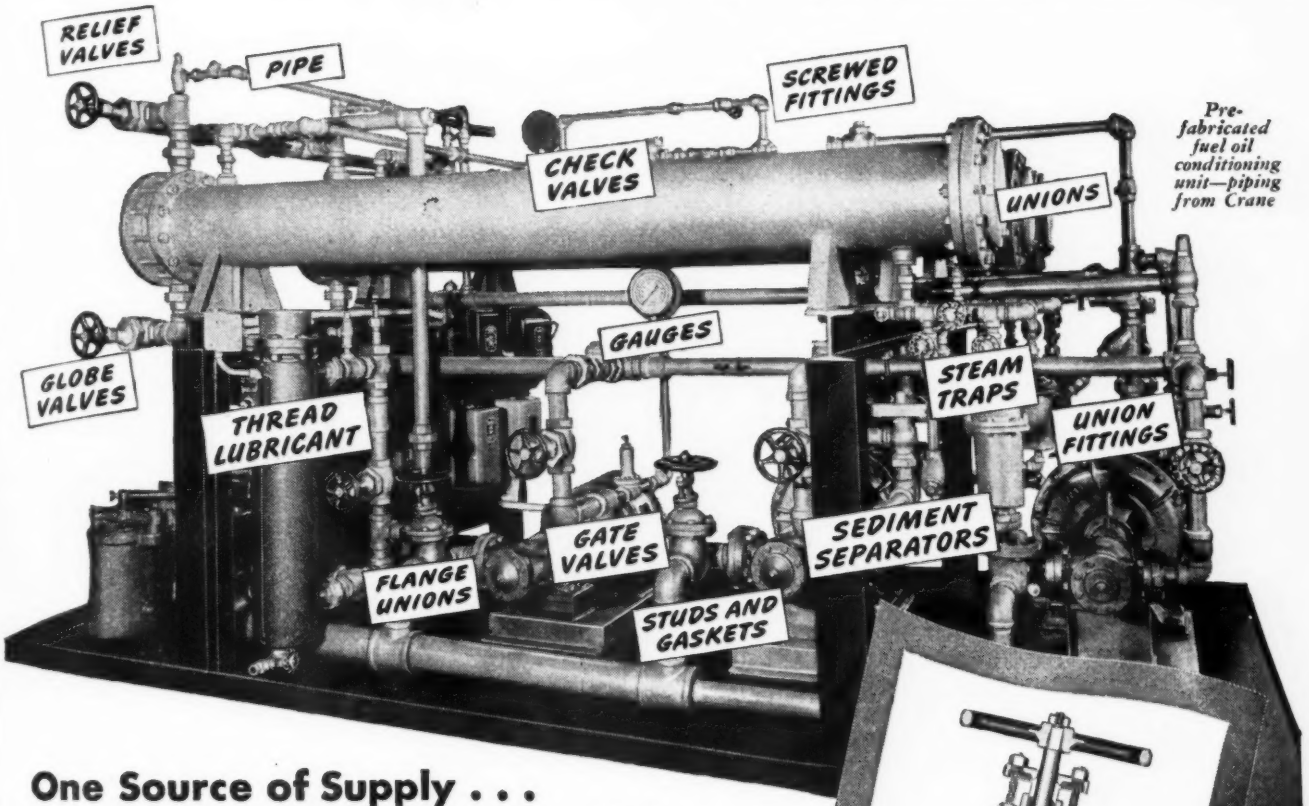
Generating Set

UNIT HAS A CAPACITY of 50 or 60 kw, dc, at 230 v. It is driven by a 6-cylinder Waukesha-Hesselman diesel, equipped with radiator and fan, electric starter and air, fuel and lubricating oil filters. Glass and mica insulation throughout results in compact generator design. Controlled air circulation through shaft and field coils pro-

(*Continued on page* 184)



Complete systems or single fittings . . . Crane meets every piping need



Pre-fabricated fuel oil conditioning unit—piping from Crane

One Source of Supply . . . One Responsibility for Materials

In buying day-to-day piping needs—or when you're planning complete new systems—the benefits of single source supply can be yours. Crane supplies everything for piping—valves, fittings, pipe, and all accessories—as indicated by the installation above. And where can you expect more complete selection than in the world's largest line of flow-control equipment for every service.

Ordering—handling parts stocks—maintenance—all these operations are simplified when you Crane equip. More important, one responsibility for quality and craftsmanship of piping materials is a primary aid to good installation. Crane meets that responsibility with 89 years of manufacturing experience.

CRANE CO., 836 S. Michigan Ave., Chicago, Ill.

STANDARD IRON BODY WEDGE GATE VALVES

One Standard of Quality . . .

Because there is adequate quality in every part, the whole system is thoroughly dependable when it's Crane equipped. Such quality is typified by Crane Iron Body Gate Valve design: Strong body sections resist severest line strains. Straight-through ports give streamline flow. A deeper stuffing box lengthens packing life. Extra long guides keep disc travel true, while balanced stem design maintains smooth and positive operation.

CRANE

VALVES • FITTINGS • PIPE

PLUMBING • HEATING • PUMPS

A Man Can Grow.....

In 1861, U S Grant was just a retired Army colonel running a country store; in 1865, he was America's greatest general. In 1860, Abraham Lincoln was just an obscure country lawyer-politician with a gift for spinning yarns; in 1865, he was his country's greatest president.

This may not have been original with the speaker I heard use it, but it struck me as something well worth putting down. It indicates how suddenly a man may grow to fill a need.

Eisenhower, Clark, McNair, Somervell, Arnold, King, Halsey—none of these men was known a few months before Pearl Harbor. So it is in any plant or any group. There are always latent abilities, unsuspected skills that crop up only when necessity forces them out. Tomorrow's leaders are in a plant or a foxhole today.

Chief engineers in Louisville were amazed at the versatility and ingenuity of their crews when the 1937 flood swept away normal tools and expected conditions. One man thought of a steamboat to replace a flooded-out boiler plant. Another suggested electrical conduit for temporary pipelines. Still another took a desperately needed air compressor from a locomotive. One even remembered the only possible local source for a pair of waders—the Baptist minister.

These are not unusual examples. Others just as ingenious come to light every time a real squeeze forces them out. And the men who have the ideas thereby step out ahead of their fellows.

For this condition we can all be thankful, because our leaders thus are chosen from the men with needed answers. And the chances are good that a man who has one idea will pop up with others.

George Edwards
Engineer

FOR over 25 years, engineers have depended on Johns-Manville Service Sheet for their gaskets. As a result of its performance under widely varying temperature and pressure conditions against steam, oil and other fluids, gases and chemicals, J-M Service Sheet is recognized as the No. 1 sheet packing today.

Over the years, J-M Service Sheet has been constantly improved to meet the increasingly severe demands of industry. Its dependability and high degree of uniformity are the result of quality ingredients and special manufacturing techniques developed during nearly three-quarters of a century of experience in the production of packings.

For details on Johns-Manville Service Sheet and on the complete line of J-M Packings and Gaskets, write Johns-Manville, 22 East 40th Street, New York 16, N. Y.

JM

Johns-Manville PACKINGS & GASKETS

THERE'S A DISTRIBUTOR NEAR YOU

POWER NEWS

Washington Notes . . . Business Items . . . War and Postwar Pointers . . . Appointments in Power Field . . . Conventions

California Gets New Hydro Turbines

Formal opening of Pacific Gas and Electric Co's Pit River No. 5 plant in north central California was held April 29 as the station's four 32,000-kw hydro turbines went on the line.

Originally scheduled for operation late last year, the project was delayed by bad ground conditions, which caused considerable difficulty in completing a 28,000-ft diversion tunnel from the dam to the powerhouse.

Meanwhile, work at the Interior Dept's Shasta Dam near Pit River No. 5 was nearing completion, with two 75,000-kw hydro units scheduled to go on the line in June. Some concreting and replacement of bulkheads with gates remains to be done at Shasta.

When both projects have been completed, they will bring the area's firm capacity up to desired levels and provide some peaking capacity that will be needed this summer. Some fuel savings, largely gas, will be effected.

Across the country, New York's Consolidated Edison Co ordered a 65,000-kw topping turbine from General Electric Co for installation late in 1945, in Hell Gate station, located in the Bronx, New York City.

OWU has assigned AA-3 ratings for three steam turbine-generators: A 60,000-kw unit for the Atkinson plant of Georgia Power Co, a 65,000-kw machine for the Springdale plant of West Penn Power Co and a 50,000-kw unit for the Dixon plant of Illinois Northern Utilities Co. Units will begin operation by late summer or early fall, 1945.

Navy Needs Men

Men are needed as officers in the servicing, maintenance and repair of internal-combustion engines in operating vessels in advanced areas.

Qualifications: An engineering degree from an accredited college with at least five years' experience in machinery, manufacturing and installation or service on steam turbines, internal-combustion engines, reciprocating steam engines or electrical machinery, both ac and dc. Without a degree, applicants must have at least ten years' experience and must have had responsible charge of work in machinery, manufacturing, installation or servicing of the types mentioned above.

Applicants familiar through experience with machinery actually in use in the U. S. Navy will receive preference. Age, 24 to 50. Applicants must meet Navy physical requirements and possess officer-like qualities.

Make application to Office of Naval Officer Procurement, 33 Pine St, New York 5, N. Y., or to other procurement offices located in the principal cities throughout the U. S.

Frank B Allen

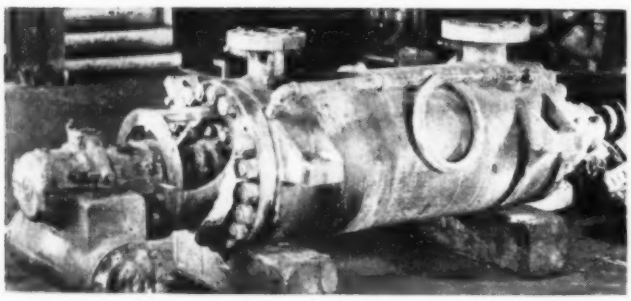
Frank B Allen Awarded Longstreth Medal

The Edward Longstreth Medal of The Franklin Institute was awarded on April 19 to Frank B Allen, president, The Allen-Sherman-Hoff Co, Philadelphia, for his invention of a *seal ring* for centrifugal pumps (Hydroseal pumps) handling abrasive solutions.

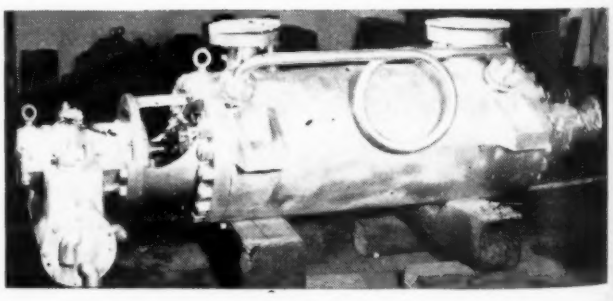
The citation included: "In consideration of the development of a pump (Hydroseal) which will successfully handle water or liquids containing abrasive materials, retain its initial efficiency and original discharge for considerable periods, with low maintenance costs

(*Continued on page* 156)

VETERAN GOES BACK TO SERVICE AFTER OVERHAUL

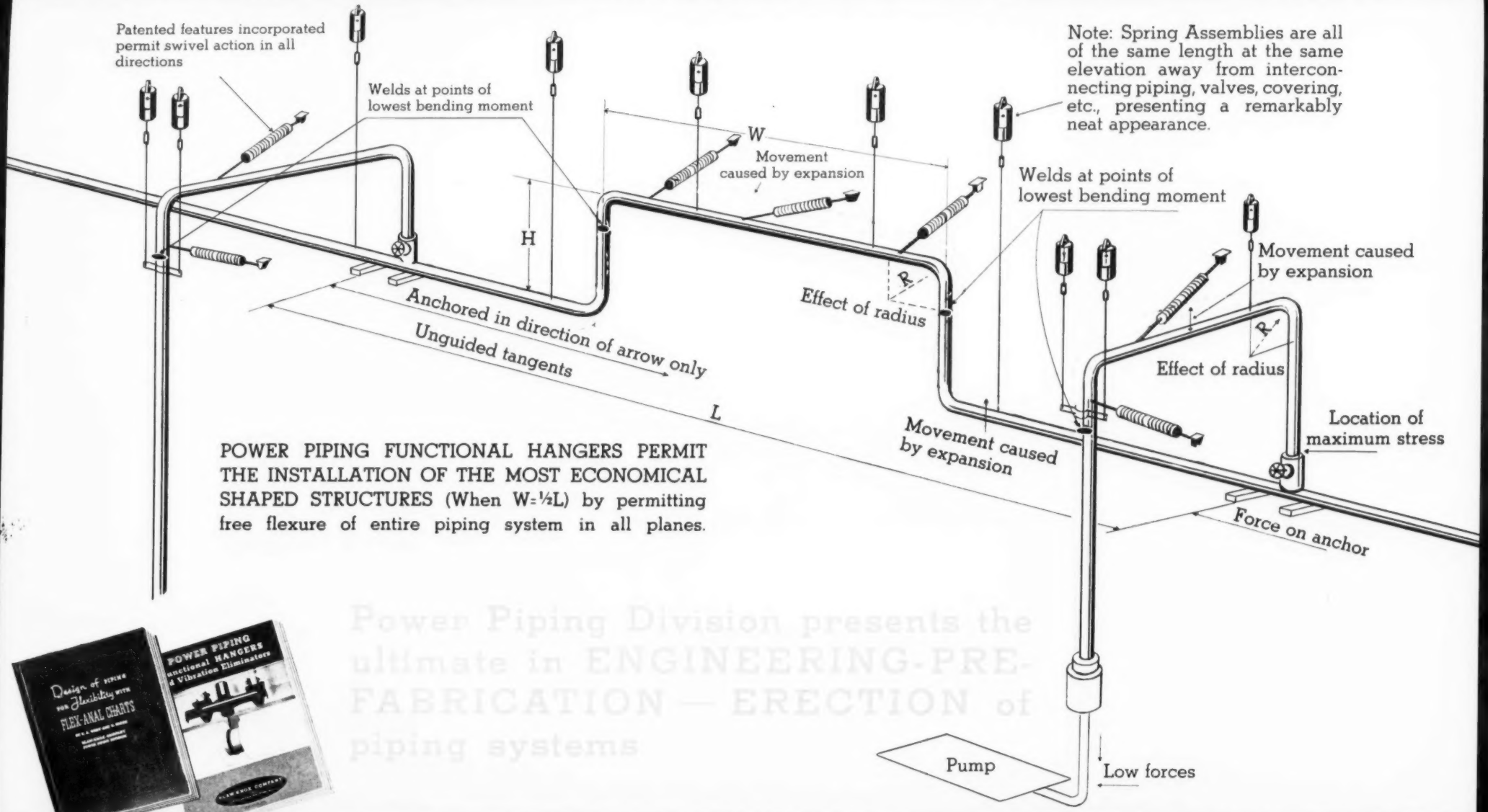


BEFORE **This 4-in. 10-stage 680-gpm centrifugal pump was returned, just as it is shown in the photo, from a West Coast plant to the manufacturer, Pacific Pump Works, for a complete checkup and modernization. It had operated for ten years of practically constant round-the-clock service at 1750 psi and 850 F**

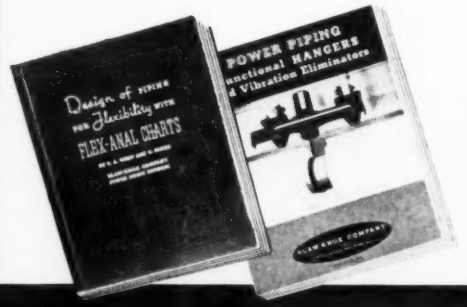


AFTER **Pump parts that were replaced in reconditioning the veteran include new wearing rings, intermediate cover bushings, shaft sleeves and a new design of floating seals. The double-case pump with forged-steel outer casing and chrome-steel inner case and fittings is driven by a 900-hp steam turbine at 3450 rpm**

PIPING PROBLEMS


Patented features incorporated permit swivel action in all directions
Welds at points of lowest bending moment
W
Movement caused by expansion
H
Anchored in direction of arrow only
Unguided tangents
L
Effect of radius
R
Note: Spring Assemblies are all of the same length at the same elevation away from interconnecting piping, valves, covering, etc., presenting a remarkably neat appearance.
Welds at points of lowest bending moment
Movement caused by expansion
Effect of radius
R
Location of maximum stress
Movement caused by expansion
Force on anchor
Pump
Low forces

POWER PIPING FUNCTIONAL HANGERS PERMIT THE INSTALLATION OF THE MOST ECONOMICAL SHAPED STRUCTURES (When W=½L) by permitting free flexure of entire piping system in all planes.



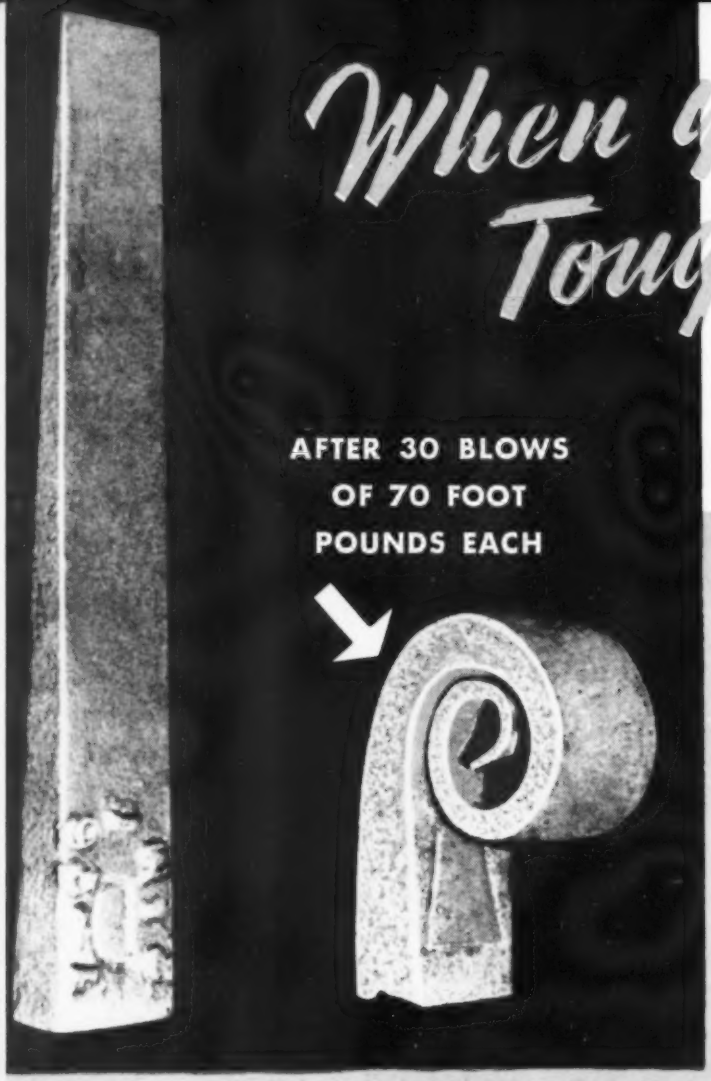
The correlated use of FLEX-ANAL CHARTS and HANGER BULLETIN 1863 saves time in engineering man power which can be devoted to other useful purposes. Copies of these books can be obtained through a request on your business letterhead.

Power Piping Division presents the ultimate in ENGINEERING-PRE-FABRICATION — ERECTION of piping systems

BLAW-KNOX COMPANY
POWER PIPING DIVISION
1525 PENNSYLVANIA AVE. PITTSBURGH, PA.

When you need Toughness like this

-- specify JENKINS AIR FURNACE



Malleable Iron survives this brutal test without fracturing

The wedge test is convincing proof of the toughness and shock-resistance of Malleable Iron, and shows why these new Jenkins Valves stand up under valve-torturing strains. The Malleable Iron Founders Society Bulletin describes the test as follows . . .

"The wedge used is 1" wide and tapers from ½" thickness to 1/16" in a length of 6". The specimen is tested as cast. A small drop hammer weighing 21 lbs. is dropped on the tip from a height of 3.33 ft. Each blow is equivalent to 70 ft. lbs.

"The test is extremely severe in that the first blow falls on 1/16 of a square inch, and each succeeding blow on a somewhat larger section, depending on the extent of the curl. Wedges tested in this manner regularly withstand more than 20 blows."

ONLY THE TOP-GRADE *AIR-FURNACE* MALLEABLE IS USED FOR JENKINS VALVES

Strongest of all the several types of Malleable Iron is *Air Furnace* Malleable. Top-rated grade is Air Furnace Standard Specification ASTM-47-33, Grade No. 35018 . . . the type used by Jenkins.

COMPARE	TENSILE STRENGTH	SHOCK RESISTANCE		TEMP-ERATURE LIMIT	CORROSION RESISTANCE (Relative)	VALVE COST (Relative)
		YIELD POINT	ELONGATION IN 2 INCHES			
ASTM 126-30 CAST IRON	34,000 LBS. PER SQ. IN.	0	0	TO 450°F		
ASTM 47-33 AIR FURN. MALL. GRADE 35018	53,000 LBS. PER SQ. IN.	35,000 LBS. PER SQ. IN.	18%	TO 450°F		
ASTM 95-36 CARBON STEEL	70,000 LBS. PER SQ. IN.	36,000 LBS. PER SQ. IN.	22%	TO 750°F		

Meet U. S. Standards – Jenkins Air Furnace Malleable Iron Valves meet the standards of the U. S. Maritime Commission, and the Bureau of Marine Inspection and Navigation, U. S. Coast Guard.

High Corrosion Resistance – Air Furnace Malleable Iron Valves resist corrosion better than carbon steel or cast iron valves. This advantage, combined with high impact resistance, recommends these new valves for marine, petroleum, mining, and various chemical and other industrial services.

JENKINS VALVES

BRONZE · IRON · STEEL

FOR EVERY INDUSTRIAL, ENGINEERING, MARINE, PLUMBING-HEATING SERVICE

to prevent destruction like this

MALLEABLE IRON VALVES

FOR the services in every plant where valves must take unusual punishment, but where pressures and temperatures are not high enough to require steel valves, Jenkins now offers Air Furnace Malleable Iron Valves.

Developed for strenuous war services, their remarkable resistance to severe strains, heavy blows, – even the shock of nearby explosions – has been thoroughly proved. The metal is the same as that used for thousands of vital parts in the hardest-hitting U. S. war equipment.

These new valves offer a two-way saving to many plants. Their first cost is considerably less than that of carbon steel valves, even though they compare favorably in strength and impact resistance. Also, they save by eliminating costly valve breakage and service interruptions.

Next time you order valves for use *where steam pressure does not exceed 150 pounds, and where temperature is not above 450° F.,* check service conditions closely. If the valves will be subject to destructive shocks and strains, and if corrosive conditions are bad, specify Jenkins Air Furnace Malleable Iron Valves . . . for trouble-free service . . . for *double* savings.

WRITE FOR BULLETIN No. 192 and specification sheets, which are sized to fit handily into your Jenkins Catalog. They describe the complete new line – the patterns illustrated here, sizes 2″ to 6″. Write to Jenkins Bros., 80 White Street, New York 13, N. Y.

Jenkins Bros., 80 White Street, New York 13, N. Y.; Bridgeport, Conn.; Atlanta, Ga.; Boston, Mass.; Philadelphia, Pa.; Chicago, Ill. Jenkins Bros., Ltd., Montreal; London, England.

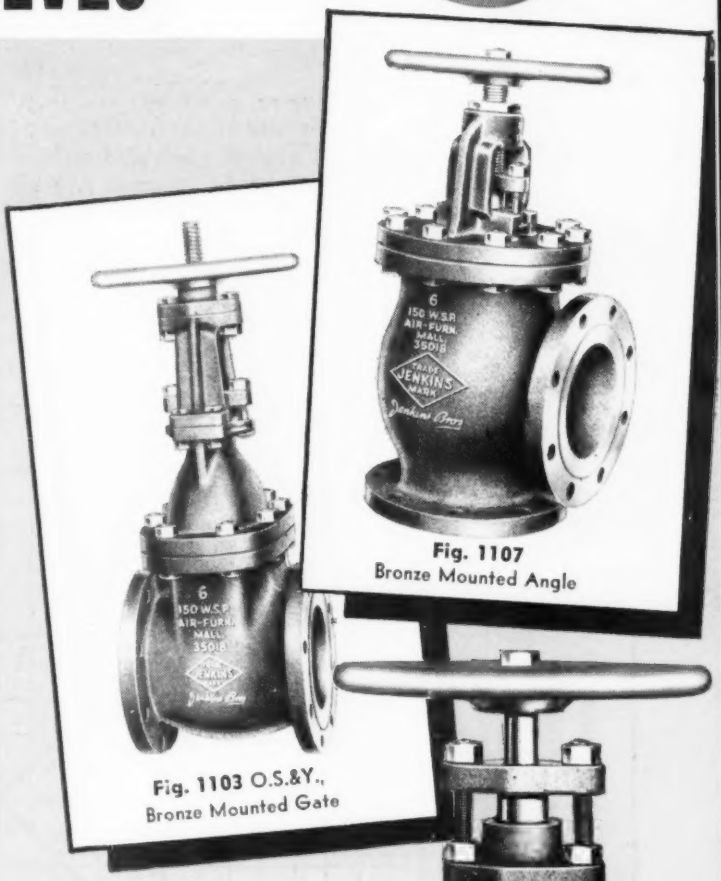


Fig. 1107
Bronze Mounted Angle

Fig. 1103 O.S.&Y.,
Bronze Mounted Gate

Fig. 1101
Inside Screw, Bronze Mounted Gate

Fig. 1105
Bronze Mounted Globe

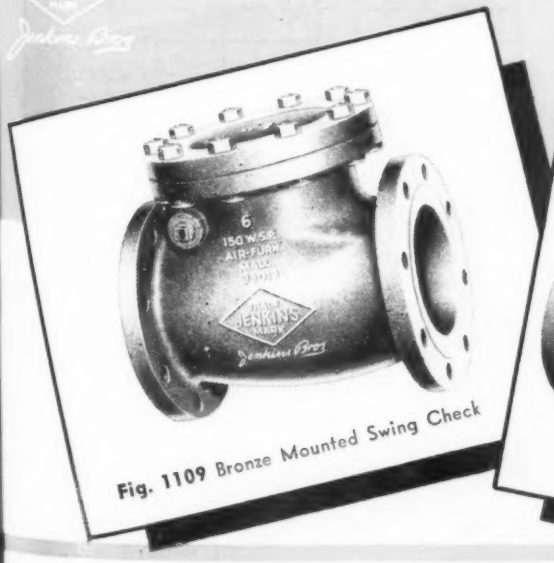


Fig. 1109 Bronze Mounted Swing Check

POWER'S
DATA SHEETS

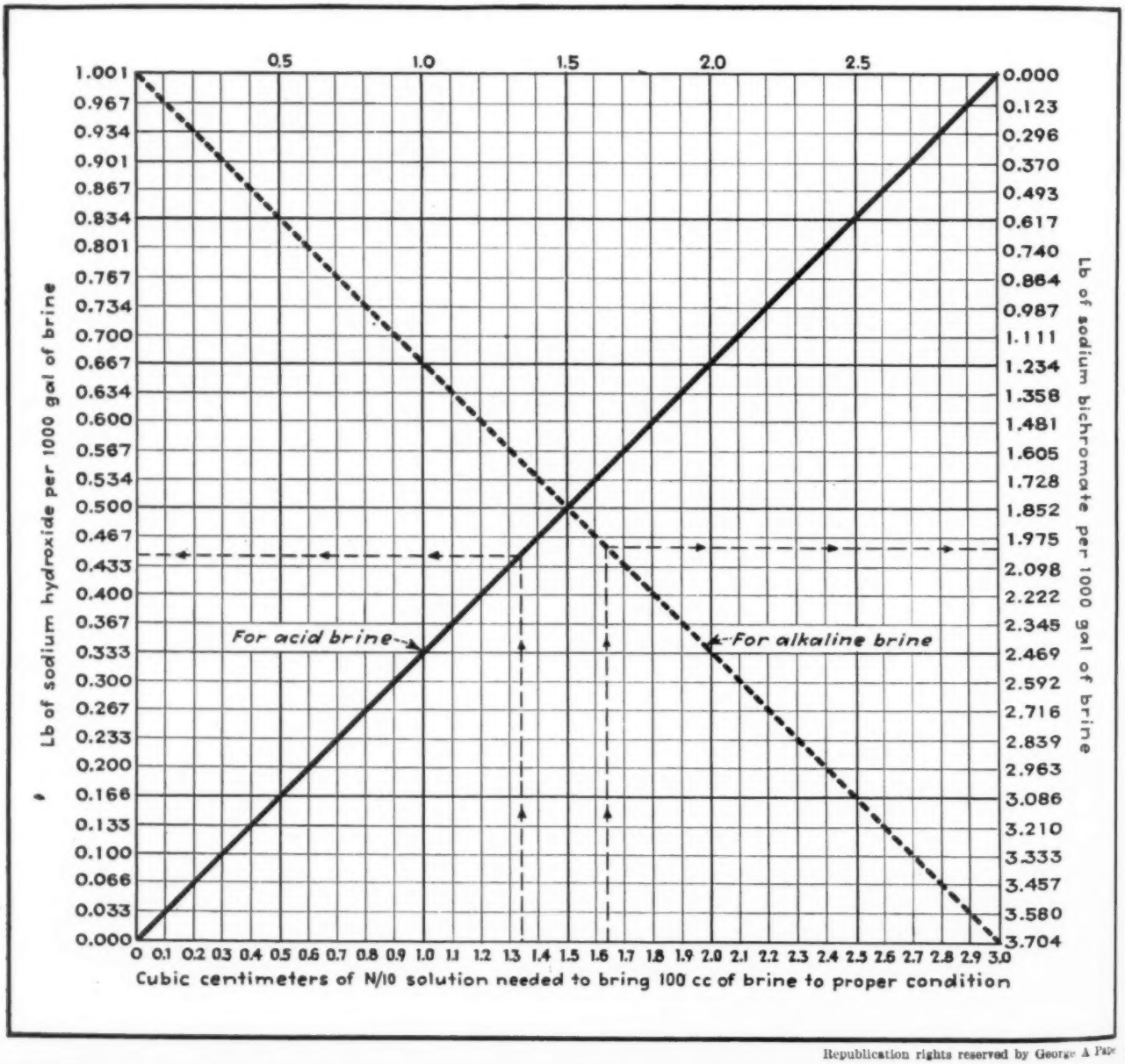
Number 142

Calcium or Sodium-Chloride Brine Adjustment

How to apply the chart: Assume in Example 1 that brine pH is 6.9 and in Example 2 that brine pH is 9.5—both to be adjusted to pH 8.0.

Example 1. While agitating 100 cc of clear brine (pH 6.9), add to it with a calibrated pipette or burette enough decinormal sodium hydroxide (N/10 NaOH) to bring the sample to pH 8.0. Suppose it takes 1.35 cc. Find this value on bottom horizontal line and follow vertically to *solid* diagonal line. Read 0.450 lb of caustic soda (sodium hydroxide) per 1000 gal of brine on left-hand scale.

Example 2. While agitating 100 cc of sample (original pH 9.5) add enough decinormal hydrochloric acid (N/10 HCl) to bring its pH to 8.0. Suppose it takes 1.65 cc. Find this value on bottom horizontal line and follow vertically to diagonal *dotted* line. Read 2.036 lb of sodium bichromate per 1000 gal of brine on right-hand vertical scale.



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Score: 11 Boilers 11 Flowmatics

COPES

5-1942

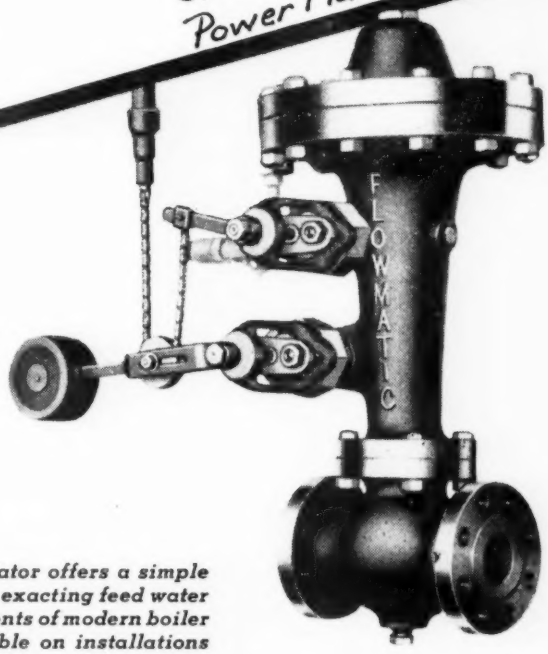
Gentlemen:

Regarding the operation of Copes FLOWMATIC REGULATORS this advises we are ~~are not~~ obtaining satisfactory results.

Remarks: We ordered three more Copes Flowmatic Regulators. Score - 11 Boilers - 11 Copes Flowmatic Regulators.

Wyman-Gordon Co.

By Max R. Boye
Chief Engineer
Power Plant



IN 1941, the Wyman-Gordon Company, Ingalls-Shepard Division, Harvey, Ill., installed their first Flowmatic Regulator. Confronted with the problem of maintaining close boiler water level control in spite of severe load fluctuations produced by forging operations, they found Flowmatic to be the correct solution. As Mr. Max R. Boye, Chief Engineer of the Power Plant, has remarked on the return card of our routine check-up, the score is now 11 Boilers, 11 Copes Flowmatic Regulators.

Proved performance of this kind accounts for the remarkable record of more than 825 Copes Flowmatic installations since its introduction only 5 years ago.

The Copes Flowmatic Regulator offers a simple reliable means of maintaining exacting feed water control geared to the requirements of modern boiler design. It is especially valuable on installations subject to severe load fluctuations. For details, write for Bulletin 429-A.

OVER 60,000 COPES FEED WATER REGULATORS IN SERVICE

NORTHERN EQUIPMENT COMPANY • 641 Grove Drive, Erie, Pa.
Feed Water Regulators • Pump Governors • Differential Valves • Liquid Level Controls • Reducing Valves and Desuperheaters
BRANCH PLANTS IN CANADA, ENGLAND • REPRESENTATIVES EVERYWHERE

★ GET CLOSER LEVEL CONTROL WITH THE COPES FLOWMATIC ★ REGULATOR

FEEDS BOILER ACCORDING TO STEAM FLOW-AUTOMATICALLY

PREVENT

Rust·Scale·Dirt

FROM CLOGGING

STEAM EQUIPMENT

YARWAY

STRAINERS

"The Screen's the Thing"

- *A High Grade Monel Woven Wire Basket* with mesh fine enough to catch the dirt—yet ample free area for passage of clean condensate, oil and other fluids.
- *Body Cadmium Plated Inside and Out for Protection Against Corrosion.*
- *Readily Removed Steel Blow-Off Bushing.*
- *Bushing Automatically Aligns Screen.*
- *Thousands in Use—Sold by Over 100 Mill Supply Houses.*
- *6 Sizes ½" to 2" for Pressures up to 600 Lbs.*

See Your Supply House or write for Bulletin S-200

YARNALL-WARING COMPANY

100 MERMAID AVENUE PHILADELPHIA 18, PA.

YARWAY STRAINERS

Steam Turbines

(*Continued from page* 78)

tubes connected in push-pull arrangement. In the first-stage double triode, only one set of elements is active, the other three being connected so they are always at the same potential.

To prevent incorrect relay operation if an electron tube fails, cathode circuits of the three stages are connected in series with an instantaneous relay, as indicated by the circuit with arrowheads. Under normal condition relay *R* holds its top contacts closed. A cathode failure in any of the tubes causes relay *R* to close its bottom contacts and lamp *L* to flash for the operator's attention.

Amplifier output is rectified by a copper-oxide bridge circuit. the dc output of which is wired to relays and a vibration recorder, if used. The diagram shows only the vibration-alarm relay. It is a simple, hinged armature device with a variable resistor connected in parallel with its coil, the former adjusting operating current value in the coil. The relay is adjusted so that it closes the alarm circuit when the vibration detector is subjected to an 8-mil amplitude vibration, warning that vibration amplitude is approaching the danger point. At a 12-mil bearing vibration the master relay trips the main generator and field breakers.

The authors conclude that the electronic system provides suitable protection to rotating machines against vibration caused by either magnetic or mechanical unbalance. This equipment, in service since 1942, has a satisfactory record for large turbine-generator protection. Such vibration protection permits safe operation of generators with a single ground in their field windings.

Rotor-Winding Protection

Field Winding Deformation. A peculiar deformation of the rotor field coils has caused several failures in steam-turbine-generator rotor winding. In his paper, John G Noest, Consolidated Edison Co of New York, gives causes and preventions of this deformation, the basic causes of which, he says, can be explained by an examination of starting, loading and shutting-down procedure for steam turbine-generators.

Starting with the machine at approximately room temperature it operates from 0.5 to 2 hr at low speed. Near the end of this turbine-warming-up period the machine is quickly brought to rated speed, field excitation applied, the gen-

STREAMLINED

Tube-Turn welding fittings help to bring true streamlining to a piping system. They not only save space and weight, but permit neater layout and *more compact design*, with lines of piping nestling closely together, hugging walls and making the best use of corners or odd spaces. Insulation is far easier in piping systems where Tube-Turn welding fittings are used.

Tube-Turn seamless steel welding fittings themselves are basically streamlined. Their smooth inner surface, easy sweeping turns and full circularity reduce pressure loss and flow resistance at vital points where flow direction changes. No flow-impeding "offsets" where Tube-Turn fittings are used — no waves or ridges to accelerate corrosion or erosion! Write for Catalog 111.

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erator synchronized to the bus and loaded.

In this starting procedure, rotor field current is not applied until after nearly maximum centrifugal force, produced by rotor speed, has developed to lock the field-winding conductors in their position at starting. As a result, the rotor winding is not subjected to the effects of temperature rise due to field current until after the conductors are acted upon by centrifugal force. As the temperature of the coils increases, these conductors tend to expand axially but are opposed by frictional resistance created by action of centrifugal force. This force is sufficient to lock the rotor conductors to each other and to the slot wedge for a large portion of the coil length.

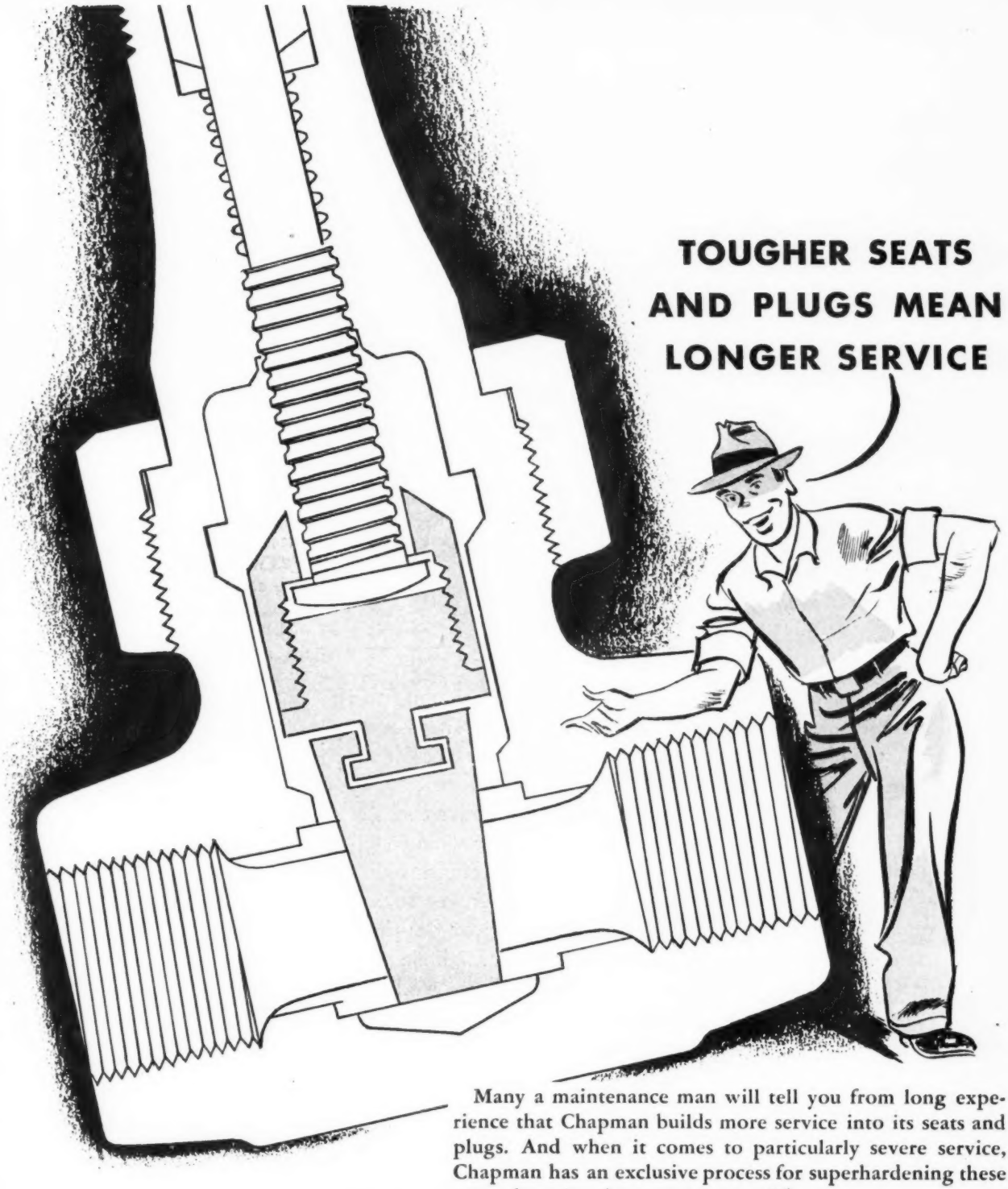
At some critical temperature rise in the field-winding conductors the axial expansion force becomes sufficient to exceed the elastic limit of the metal and is given a permanent deformation. When the generator is shut down and cools, the field coils cool without the restraint of centrifugal force and are free to contract in their slots. Coil deformation under high temperature is retained and it is permanently shortened when cooled. Repetition of this starting, loading and shutting-down cycle results in continued coil deformation until it may cease because of hardening effects of plastic working of the metal.

Preheating Rotor Winding

Mr. Noest tells how to prevent deformation by preheating the rotor winding and core while rotating at slow speed. Thus, the rotor core and conductors expand, as their temperature increases, free of frictional restraint by centrifugal force.

When preheating the rotor winding, bring the temperature distribution in the winding as nearly as possible to that existing when the generator is loaded. This desirable condition can be approached only if preheating is done with normal air flow through the generator. However, with preheating at slow speed and with shaft-driven blowers, air flow through the machine cannot be normal.

Under these conditions it may be necessary to preheat in two steps: (1) Start at relatively high rotor speed for the desired ventilation (2) reduce the speed in one or more steps to prevent excessive winding stresses. At each step of speed, stresses in the field coils are released, until specified preheating temperature exists. Then a final slowdown to rest releases all stress in the rotor winding before the generator is accelerated and synchronized. On gen-



TOUGHER SEATS AND PLUGS MEAN LONGER SERVICE

Many a maintenance man will tell you from long experience that Chapman builds more service into its seats and plugs. And when it comes to particularly severe service, Chapman has an exclusive process for superhardening these parts that give them even longer life.

When these parts finally do wear out, you'll find Chapman standing by ready to see that you get replacements *quickly*.

Other Chapman extra-service features are quick-acting threads that open and close without sticking or freezing... and full pressure repacking—made possible because the pressure is not transmitted to the stem.

That's why so many experienced power men stand by Chapman List 960.

Specify

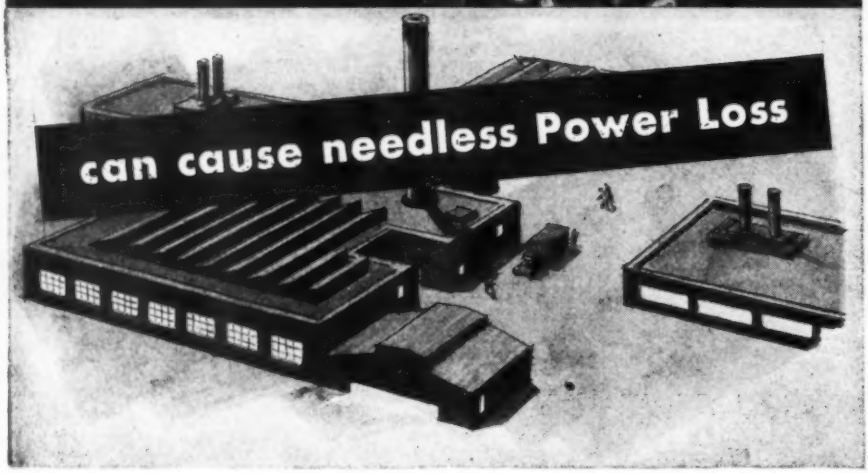
CHAPMAN LIST 960

FOR LONGER LIFE

THE CHAPMAN VALVE MFG. COMPANY

INDIAN ORCHARD, MASSACHUSETTS

"BUGS" THAT INSULATE



Microbiological slime growths in condenser tubes may hamper heat transfer enough to require the needless use of hundreds of tons of fuel.

Mechanical cleaning is not a satisfactory solution. Not only is it expensive in man-power and loss of production time, but it is merely a temporary remedy since the slime may immediately begin to grow again.

The problem can be solved permanently by the Wallace & Tiernan Desliming Process, which destroys and clears out the growths already present, and prevents their recurrence—without requiring even a single hour shut-down.

W&T Engineers have successfully handled severe slime conditions in scores of plants where the circulating water was so bad that condensers lost one-half inch of vacuum overnight. In fact, in many cases where W&T desliming methods are employed, condensers are now maintaining vacuums above the manufacturer's guarantee. Write for technical information.

CD-6

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erators having separate blowers this difficulty is not likely to exist.

The Consolidated Edison system has adopted preheating of rotor windings for fire generators having rating of 60,000 to 200,000 kva. All these units have external motor- or turbine-driven blowers, closed cooling systems with air coolers, shaft rotating gear and a field rheostat in the rotor circuit. The following preheating procedure, for a 160,000-kva 1.0-pf 25-cycle 1500-rpm unit, is equivalent on all machines:

Preheating Procedure

1. Depending on how long the machine is shut down preheating varies from 1 to 2.5 hr. Generally warming-up time of the turbine varies similarly, but preheating can be started with the generator shaft rotated at 2 rpm by the rotating gear. Preheating is not done at standstill to avoid burning the collector rings.

2. With generator rotated by the turbine at not over 300 rpm or on the rotating gear, a preheating current equal to 84% rated excitation is applied to the rotor winding. Generator cooling fans supply practically normal air flow through the generator.

3. When rotor-winding temperature approaches a specified preheat temperature, cooling water is turned on to control the temperature, while preheat current is held constant. Rotor-winding preheat temperature in relation to cooling-water temperature is: Cooling-water temperature, up to 45 F; preheat winding temperature, 65 C; water, 46 to 60 F; preheat, 73 C; and water 61 F and over; preheat, 81 C.

4. When the specified preheat temperature is reached and the turbine warmed up, generator is stopped to relieve all stresses that may have accumulated in the rotor windings, and immediately restarted with the field current unchanged.

5. Turbine is rapidly accelerated. As speed increases above 1000 rpm, operator reduces preheat current enough to prevent excessive generator voltage. When generator reaches synchronizing speed, rotor winding is quickly switched from preheat supply to shaft exciter, voltage adjusted to normal, generator synchronized and loaded.

Mr. Noest concludes that preheating rotor windings and core of turbine-generators keeps rotor-winding deformation to a minimum and increases winding life. In some cases, generator overloading can be made safe if rotor windings are preheated. Practical procedures for preheating the rotor winding are easily coordinated with turbine starting.

Many plants discover

it costs less to use COPPER TUBES

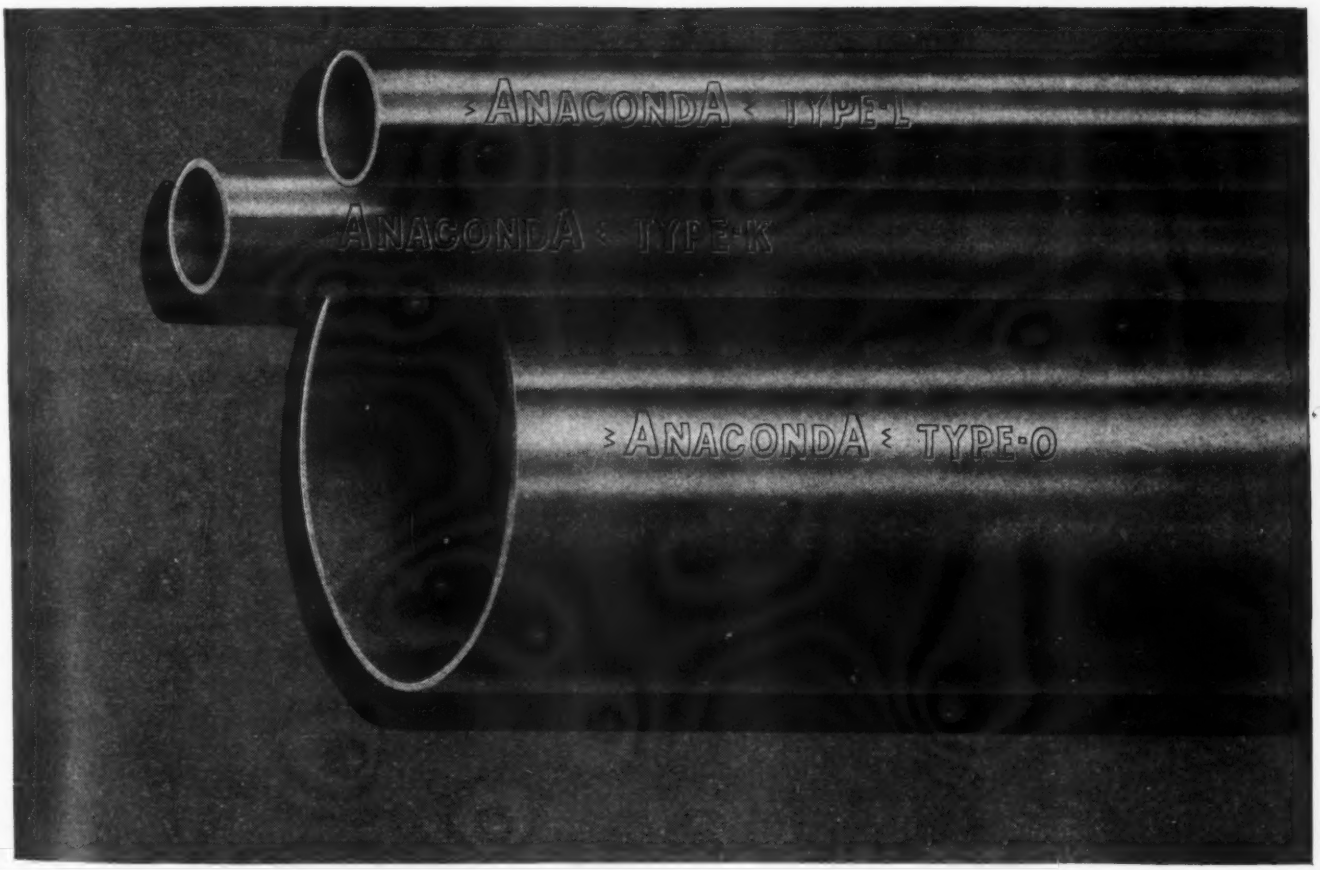
COPPER TUBES cost more by-the-foot, but in the experience of many plants, they cost less *by-the-year.*

Rustless and corrosion resistant, copper tubes are durable, retain smooth interiors that reduce pumping costs, are lighter in weight and provide (in the most commonly used sizes) important savings in installation cost. Longer tube lengths and the bending of tubes around obstructions reduce the number of fittings and joints required. Where elbows, tees or other connections are necessary, the solder-type fitting is used with a minimum of installation time. Important too, is the fact that soldered connections may be readily disassembled and reinstalled when plant alterations make it necessary to change the location of the pipe lines.

Present use of copper tubes is drastically curtailed by war demands. But it will pay you to look ahead to the day when this worthwhile piping is again generally available. Publication C-24, sent on request, describes industrial applications of Anaconda Copper Tubes.

44102

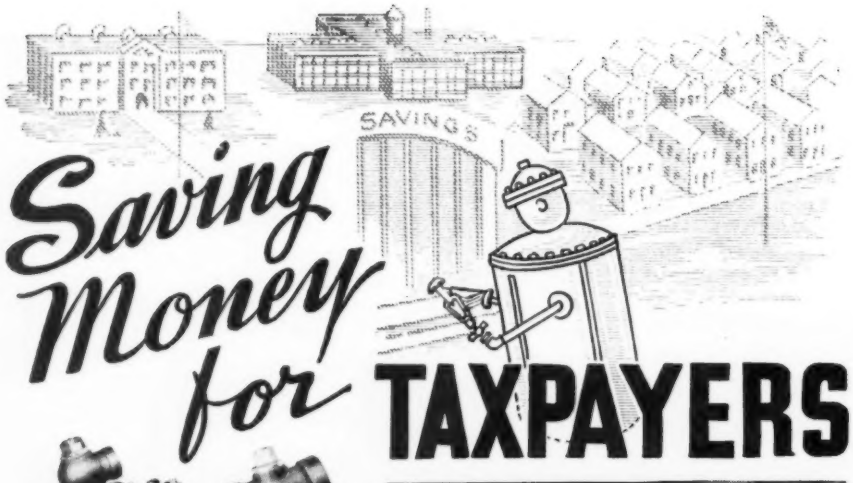
Types K and L tubes made in nominal sizes, from ⅛" up to and including 12". Type O tubes made in nominal sizes from 3" to 12" inclusive.



ANACONDA *Anaconda Copper Tubes*

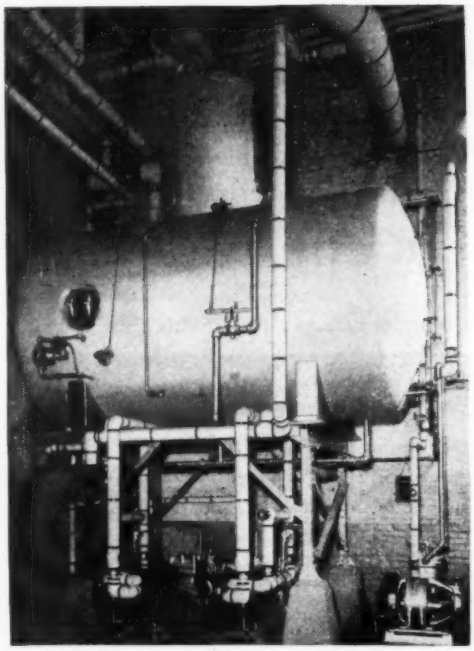
THE AMERICAN BRASS COMPANY—General Offices: Waterbury 88, Connecticut

Subsidiary of Anaconda Copper Mining Company • *In Canada:* ANACONDA AMERICAN BRASS LTD., *New Toronto, Ontario*



Saving Money for TAXPAYERS

At Right—One of the many Stickle Open Coil Feed Water Heaters and Purifiers installed in connection with the heating plants of schools, hospitals and other public institutions. Stickle flies the Army-Navy "E" Flag with two stars for its service in supplying heaters and other equipment for military training centers. *Above*—Stickle Open Float Steam Traps. *At Left*—Stickle Reducing and Regulating Valve.



● To engineers serving public institutions and to officials and employees responsible for their operation, Stickle Open Coil Feed Water Heaters, Stickle Open Float Steam Traps and Stickle Regulating and Reducing Valves have the same appeal as to those in private industry.

Correct design and simplicity of construction are characteristics of Stickle Equipment which give plus results in operation wherever used. Stickle Equipment supplies efficiency for effective performance, dependability for constant, trouble-free operation and durability for long service life with low upkeep. For taxpayers and for private users, Stickle Equipment saves money by reducing steam costs, increasing operating efficiency and making the original investment effective for longer service.

Bulletins on Request: Bulletin No. 117, Stickle Feed Water Heaters and Purifiers; Steam Traps for medium and high pressures. Bulletins Nos. 115 and 315—for low pressures, Bulletin No. 415; Bulletins Nos. 235 and 435—Reducing and Regulating Valves.

Stickle

STEAM SPECIALTIES COMPANY

2265 VALLEY AVENUE • INDIANAPOLIS, INDIANA

SPECIALIZING FOR 40 YEARS IN REDUCING THE COST OF STEAM

Readers' Problems

(*Continued from page* 112)

boiler front, a cheap and easy way is to cut a piece of plywood to place against the air inlet, partly covering it in such a way that any desired draft may be admitted to ashpit.

Damper doors or vanes could be fitted with suitable levers or the air inlet could be extended to a convenient place. Variable-speed couplings and pulleys is another method. Motor control switches could also be used.

Laurence Harbor, N. J. ARTHUR CANNON

Advises Against Motor Control

AAB's PROBLEM seems to be one of unbalanced furnace draft; the boiler is operated with a slight furnace pressure. He can eliminate too much forced draft during refueling by installing a simple auxiliary plate damper in the duct work. Damper shaft is extended and carried out to the side of the boiler so that a connecting rod can be attached and operated from the boiler front. The plate does not have to fit tightly as it generally has to be only partially closed.

With this auxiliary damper the fireman can maintain air flow through the fuel bed and yet not cause flames to emerge from the doors. He will learn how to obtain the best operating results. This control method will not interfere with existing combustion control or other automatic devices for actuating the regular damper.

Installing a blower-motor control switch on the boiler front is not advisable because it is inefficient to operate the blower on start-and-stop control.

Brooklyn, N. Y. JOHN SALVIANI

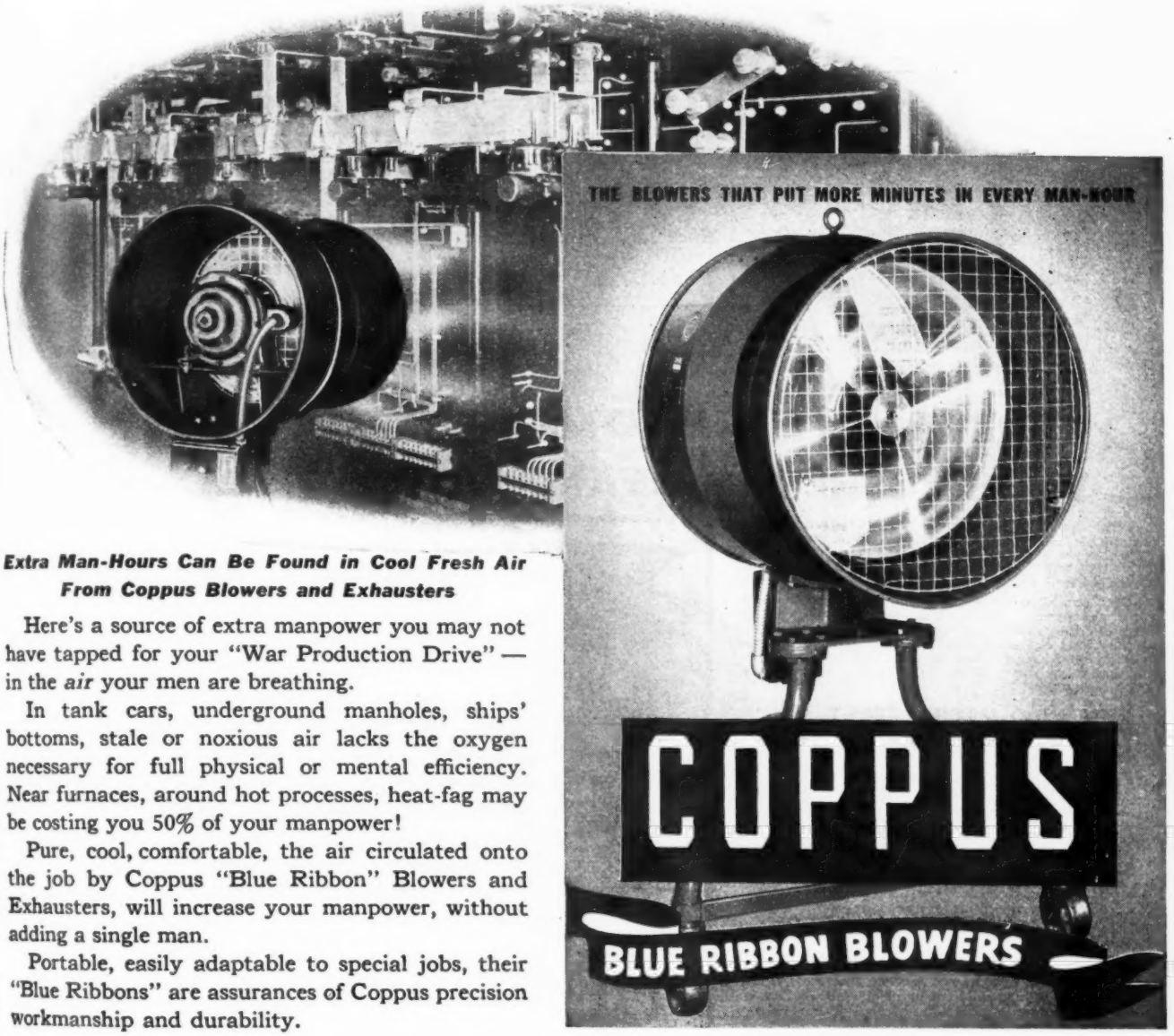
Answers to April Question 2—How do you pack valve stems?

(*Continued from page* 113)

tions a fibrous packing containing a hemp-flax base should meet this requirement.

Packing in bad condition hampers smooth, free action of regulating-valve stems, especially if the hard packing has cut or scored the stem. Valve-stem lubrication is also an important item and any method to keep stems lu-

There's Manpower in the Air



Extra Man-Hours Can Be Found in Cool Fresh Air From Coppus Blowers and Exhausters

Here's a source of extra manpower you may not have tapped for your "War Production Drive" — in the *air* your men are breathing.

In tank cars, underground manholes, ships' bottoms, stale or noxious air lacks the oxygen necessary for full physical or mental efficiency. Near furnaces, around hot processes, heat-fag may be costing you 50% of your manpower!

Pure, cool, comfortable, the air circulated onto the job by Coppus "Blue Ribbon" Blowers and Exhausters, will increase your manpower, without adding a single man.

Portable, easily adaptable to special jobs, their "Blue Ribbons" are assurances of Coppus precision workmanship and durability.

CABLE MANHOLE AND TANK VENTILATORS — BOILER MANHOLE BLOWERS AND EXHAUSTERS — HEAT KILLERS — SHIPHOLD VENTILATORS . . . DESIGNED FOR YOUR INDUSTRY — ENGINEERED FOR YOU

MAIL THIS COUPON To Coppus Engineering Corp., 516 Park Avenue, Worcester, Mass. Sales offices in THOMAS' REGISTER. Other "Blue Ribbon" Products in SWEET'S CATALOG.

PLEASE SEND ME INFORMATION ON SUPPLYING FRESH AIR TO MEN WORKING:

- ☐ in tanks, tank cars, drums, etc.
- ☐ in underground cable manholes.
- ☐ in aeroplane fusilages, wings, etc.
- ☐ on coke ovens.
- ☐ on steam-heated rubber processes.
- ☐ on boiler repair jobs.

COOLING:

- ☐ motors, generators, switchboards.
- ☐ wires and sheets.
- ☐ general man cooling.
- ☐ around cracking stills.
- ☐ exhausting welding fumes.
- ☐ stirring up stagnant air wherever men are working or material is drying.
- ☐ drying of walls, sheets; etc., after treated with coating material.

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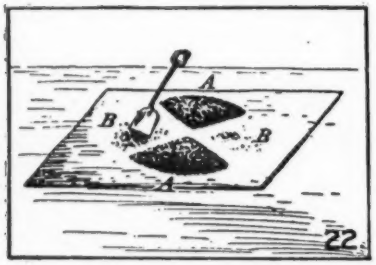
(Write here any special ventilating problem you may have.)

Is MANPOWER SHORTAGE *a problem?*

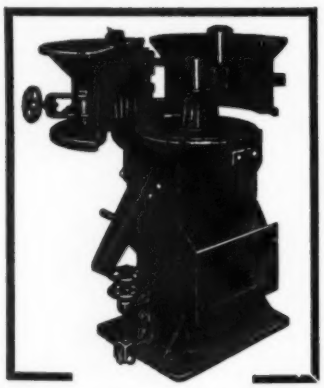
Here's just one of **34 HAND OPERATIONS** *eliminated by the*



STURTEVANT AUTOMATIC COAL CRUSHER and SAMPLER

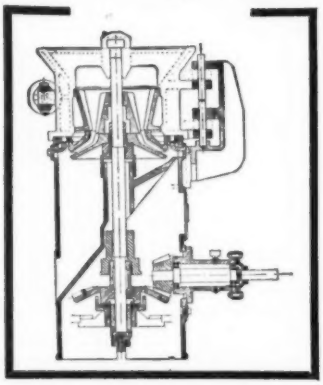
Why use manpower, already short, for inaccurate, inefficient, unsatisfactory hand sampling of coal when you can use machine power the "STURTEVANT WAY" and save men, effort, time and money and get truly accurate results?

Coal sampling by the old-fashioned hand method of shoveling, hand-crushing, mixing, quartering, piling and rolling not only involves many slow, laborious operations but every chance of human error is always present. Samples are *not* representative even at an unnecessary expenditure of manpower.

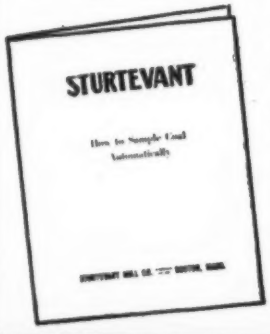


HOW THE "STURTEVANT WAY" SAVES MANPOWER

Coal to be sampled is fed into the STURTEVANT AUTOMATIC COAL CRUSHER and SAMPLER where it is reduced, crushed and thoroughly mixed *mechanically*. A homogeneous, truly representative mixture leaves the "STURTEVANT" ready for the laboratory, a mixture that correctly duplicates all the proportions of combustibles and impurities that exist in the coal from which the sample is taken. The human element is eliminated, accuracy assured and manpower saved.



WHY IT PAYS TO KNOW YOUR B.T. U.'S

Only by taking accurate, truly representative samples can you know exactly the fuel value of the coal you buy, provide a correct basis for adjusting your plant to the efficient use of the coal delivered to your bunkers and assure freedom from shut down. By sampling coal the "STURTEVANT WAY" you can be absolutely certain of its B.T.U. value and thereby assure the maximum in plant performance, capacity and economy.

Investigate the "STURTEVANT WAY"—NOW!

Send at once for illustrated booklet containing valuable information on coal sampling and the big accomplishments realized in leading plants though using "STURTEVANT" automatic method.

Sturtevant Mill Co.

103 Clayton St., Dorchester, Boston, Mass.

bricated aids greatly in prolonging packing usefulness.

Regarding cut rings or one-piece spiral packing, experience indicates little difference in the results from the two methods as long as the packing is of correct size and proper grade.

Jersey City, N. J. I S CHAMBERLAIN

Repack at Least Yearly

HOW OFTEN valve-stem packing glands can be tightened depends on the packing quality, the kind of fluid and its temperature. With 250-psi 600-F steam, valves need repacking at least once a year, and those frequently operated need it oftener.

Never wind braided coil packing around the stem; instead, cut it into individual rings. On small valves, wind twisted asbestos packing around the stem until the stuffing box is full.

Use a braided hemp, flax or cotton packing for water. For saturated steam an asbestos packing with rubber core is satisfactory. High-pressure superheated steam requires the best asbestos or metallic packing. For oil choose a packing especially made for it; steam and water packings are not suitable for oil.

Princeton, B. C. A R EASTCOTT

Check Valve Stem and Gland

FIRST THING is to check the valve and stem for trueness; especially see that the stem isn't bent and that its surface is smooth and even all around. Then check the recess for roughness and roundness. Ring packing is best as it is uniform in thickness and length. If the recess and stem have a snug fit and no binding, use soft packing.

The gland should not be tightened until the stem binds because this causes poor valve regulation and wears the stem. When tightening is necessary to prevent leakage then it's time to repack.

Ring packing serves better on large valves but on small valves it is better to use spiral packing.

Philadelphia, Pa. W T MULLEN

J A Coulden, Hamilton, Ont., uses a metal template to measure each packing ring as he cuts it from the coil. T F Cunningham, Philadelphia, Pa., suggests bringing cut ends of continuous-wrapped packing to a marked point in the gland so that gland pressure is uniform. C G Clark, St John, N. B., says that if leakage cannot be stopped without excessive tightening, he advises renewing the packing or exchanging it for a more suitable type.

SUPER- SILVERTOP'S

ONE *and* ONLY FITTING

Super-Silvertop piped straight-in-line or as an elbow needs but one fitting.

This obsolete Silvertop Steam Trap piping required 7 fittings.

There it is! One short piece of pipe — Super-Silvertop's one and only fitting necessary for installation. It doesn't cost much. And it doesn't take long to install. And, now, compare this fitting with the seven fittings and the time required to install them as shown in the illustration below. On one trap this wouldn't break any steam trap user . . . but suppose you are installing 10 - 20 - 50 or 100 traps. Mister, there's a real saving. Perhaps enough to buy an extra trap or two.

If there is a question of doubt in your mind as to what steam trap you should use, send for the book, "How to Choose a Steam Trap," it gives you complete, concise and detailed information on a steam trap to fit your particular job—it also points out the economies that can be made when you choose a SUPER-SILVERTOP STEAM TRAP.

THE V. D. ANDERSON COMPANY

1934 WEST 96th STREET • • • CLEVELAND 2, OHIO

Super-Silvertop

STEAM TRAPS

For V-DAY BUILDING

BENEFIT BY CONNERY V-STIFFENED NON-BUCKLING LEAKPROOF BREECHINGS . . . .

We take pardonable pride in the fact that 100% of Connery output is going to war production projects. And we feel certain that the many plants using (and planning to use) Connery's Improved Expansion Stiffened Construction for stacks, breechings, ducts, etc., won't mind if we give our best to "our first customer," Uncle Sam.

As government priority construction slackens, however, we will be in a position to offer old and new customers specific help on their problems of power plant construction.

STACKS
•
BREECHINGS
•
UPTAKES
•
HOPPERS
•
AIR DUCTS

RECENT INSTALLATIONS

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CONSOLIDATED GAS ELEC. & LIGHT PR. CO.	BALTIMORE, MD.
VIRGINIA PUBLIC SERVICE CO.	ALEXANDRIA, VA.
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CONNERY CONSTRUCTION CO.
Second and Luzerne Sts. Philadelphia, Pa.

CONNERY
EXPANSION STIFFENED
CONSTRUCTION

Selection of Clutches

(*Continued from page 74*)

the conditions under which clutches are used. They have advantages also for high or low speed and for forward and reverse motions or as a brake on many types of machines. They can be applied to either the driving or driven shaft of a drive, through belt, rope, chain or gear.

Select clutches with due regard for operating conditions. The seven chief factors to take into account are: (1) horsepower to be transmitted (2) shaft speed (3) shaft size (4) available shaft length on which to mount the clutch (5) number of times clutch engages per hour (6) type of load; starting, running, shock (7) over-all drive requirements.

Generally the horsepower to drive the load, or the power of the prime mover, or both are known. All manufacturers list the horsepower rating of clutches at 100 rpm, from which the size clutch for a given load can be determined when the other factors have been properly evaluated and the correct service factor applied.

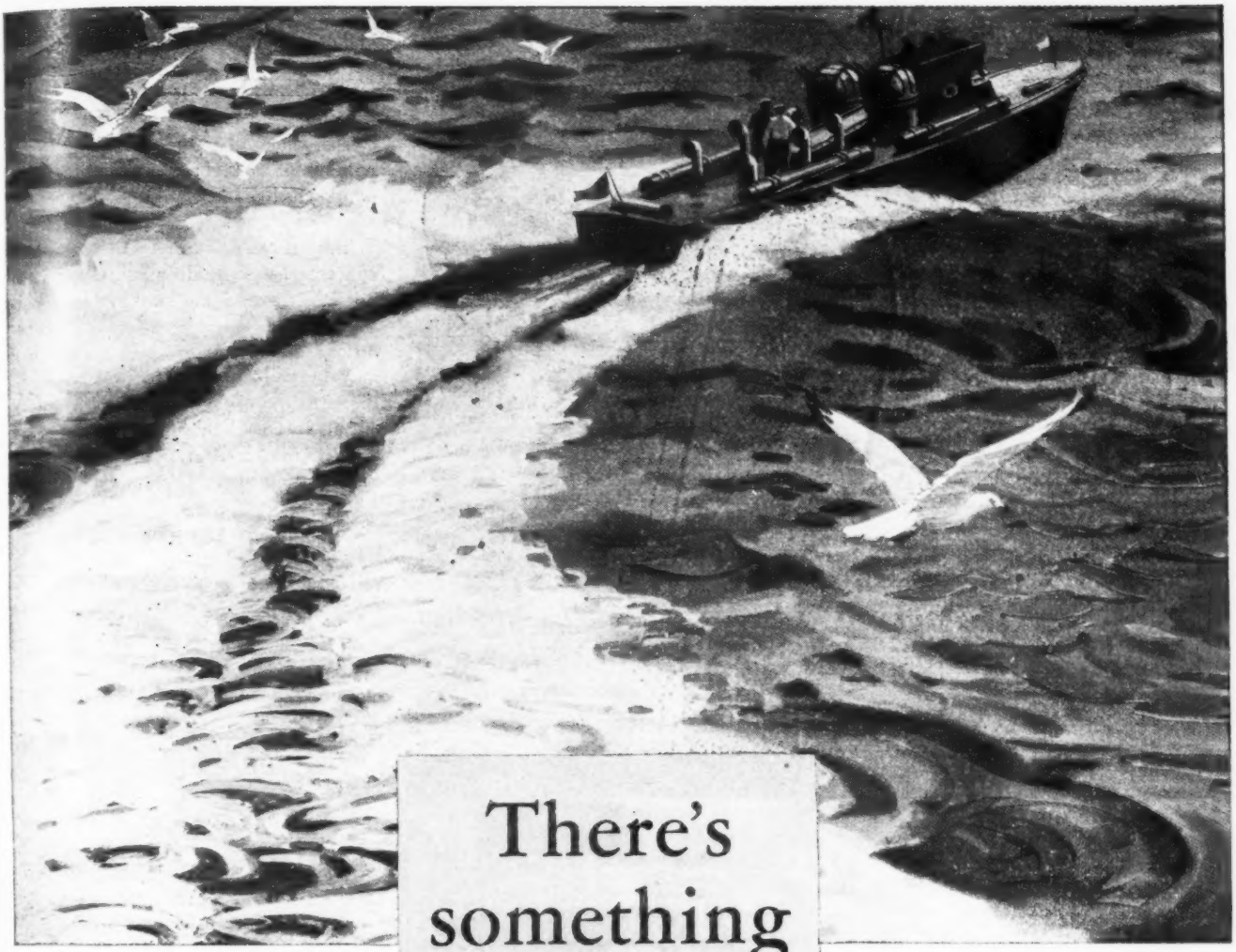
Shaft Speed a Factor

Frequently shaft speed determines clutch design for a given application. The higher the speed, the more carefully a clutch must be balanced. One that operates satisfactorily at slow or medium speed might be unsuited for high speed. Speed also determines the sleeve that can be used on a lineshaft clutch. We use wick-oiled cast-iron sleeves for speeds up to 450 rpm, bronze-bushed sleeves between 450 and 800 rpm, and ball-bearing sleeves for higher speeds except for heavy pulleys when ball-bearing sleeves should always be used.

Manufacturers list standard and maximum shaft bores for each size clutch. These dimensions are a good check on clutch size because if the standard clutch bore is much larger than the shaft on which it is to be installed, the shaft may be too small for the power transmitted, or the clutch too large. On the other hand, power installations are made sometimes with oversized shafting. This may demand a larger clutch than the load requires.

Length of shaft on which the clutch is installed sometimes determines the type. Jaw, cone, internal- and external-expanding clutches require less shaft space than do designs.

Number of engagements that a clutch



There's something coming in its wake for you ____

NEW POWER FOR A NEW WORLD

All of us are beginning to hear lots of talk about the "lessons of war." Here's something specific on the subject. We are now producing engines for the fastest, hardest-hitting battle craft in all history...engines which emphasize the true meaning of efficiency, ruggedness and dependability. These engines will open up a new era of power for the industrial and engineering projects of peacetime America.

For civilian purposes of a hundred sorts Sterling will provide engines greatly improved over pre-war designs. They will utilize the best of the wartime developments in the science of metals. They will be the product of the toughest proving ground of all time—the fighting fronts of the world.

Let's start working together now on your engine needs. It is not too soon for you to put together a well organized power program. We are glad to make available the technical ability of highly qualified engineers and the invaluable experience of practical field men.

STERLING ENGINE COMPANY, Buffalo, N.Y.
Offices in New York, Washington, Chicago.

Oil through the busiest "highways" in the world—the pipe line—is hurried along by Sterling powered pumps.

Fishing fleets will need dependable, low cost power—the kind of power that Sterling engines can provide.

A new era in railroading will be marked by higher standards of power efficiency, aided by Sterling engines.

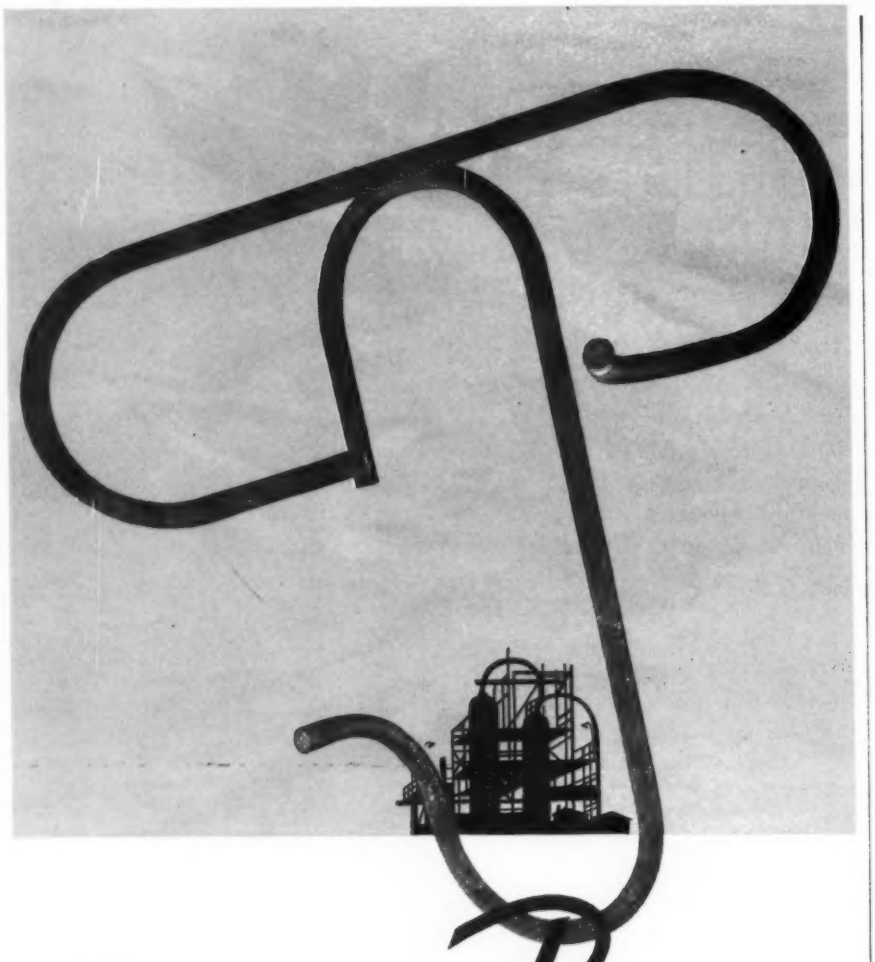
The harnessing of our natural resources will continue, with Sterling engines offering an immediate emergency power.

ETC. From air conditioning units to waterworks, wherever the need for power exists—there'll be a Sterling available.

STERLING ENGINES

GASOLINE DIESEL GAS

"KEEP BUYING WAR BONDS"



PUZZLES IN *Piping*

The two slender bends shown above are part of intricate fabrications completed in Associated shops—for use in high octane plants. These pieces fit perfectly into complex assemblies (puzzles in piping, figuratively speaking).

Literally speaking, "puzzles in piping" are solved constantly at Associated. Whether they be simple or involved we have the answers—in experience, skill, men, equipment, for engineering, fabrication, installation. Let Associated handle your piping problems.

ASSOCIATED PIPING & ENGINEERING CO., Inc.
2332 East 38th Street • Los Angeles 11, California

ASSOCIATED *Progressive* PIPING

makes per hour determine how hard it will be worked. The clutch must start the load and bring it up to speed. During this time friction faces slip, which causes them to wear and heat. If the number of engagements exceed 15 per hour select a larger clutch than otherwise.

In each class of applications the load characteristics are different. Often starting is light and the running load normal. But in other cases, starting conditions are severe or the running load may impose heavy peaks or shocks on the clutch. A shock load requires a clutch larger than for normal starting and running conditions. Shock loads include single- or 2-cylinder internal-combustion engines, punch presses, shears and similar equipment that require large power for a short time at either regular or irregular periods.

Other severe conditions include heavy starting and comparatively light running loads, such as machines with heavy mass that must be accelerated. Examples are tumbling mills, ball-and-rod mills and equipment with heavy flywheels, such as shears and punch presses.

Lastly, don't forget the conditions under which the clutch must operate. If the atmosphere is clean, dry and cool, its size may be determined by the factors previously considered. However, if atmospheric temperatures are abnormal, or dust, dirt, oil or chemical vapors are in the air they should be considered when selecting and installing clutches.

Don't forget that a properly selected clutch must be correctly installed and the shafting on which it operates kept in good alignment. Experience shows that a large percentage of all clutch troubles stem from misalignment.

Load Controls

(*Continued from page* 98)

centralized electrical control of all main circuits in outdoor substations (for blackout lighting) and automatic load control of other circuits. This cubicle is second from the left on the powerhouse switchboard, Fig. 4.

The new power setup connected a relatively small generating station to a large outside power system. This condition required special attention to insure continuity of service. Normally when an outside system connects to a generator bus the tie breaker is set to trip quickly on an outside fault of seri-

NOW JOHNNY THOMPSON'S EYES GET FEWER TREATMENTS —Because of You?...

*Not his real name, of course.

John Thompson* was a careful man, a loving husband and father. Years ago, he faced the fact that he might not always be "around" to provide for his family. So he chose life insurance to do it for him, arranging for his wife and son and daughter to have a regular monthly income. You know and we know that there is no better way to make such a thing certain. Yet, let's look at what happened after John Thompson died last year:

He had provided enough for rent and home maintenance. Enough for plain, good clothes. Enough for his talented daughter to continue the violin lessons that mean a career for her. And enough for his stout-hearted but nearly blind son to have the regular eye treatments he needs. John Thompson called these things necessities, and he even arranged for a little more, so that his beloved wife might spend a dollar now and then—"just for fun"...

He had provided all of those things...

But food costs more. Clothes cost more. Home expenses are more. Yet the family income is fixed. So there will be no more violin lessons for his daughter —fewer treatments for his son. There will be many another sacrifice, because in spite of John's careful planning and the dependable and regular insurance payments, *the dollars buy less.* Something called inflation crept in between John and his plans and made those dollars buy only 75 or 80 cents' worth of what he thought they would.

Did you help break down the security he planned for his family? Have you paid "a few cents extra" to get food over ceiling prices? Have you outbid Jane Thompson for warm clothes? If you have, and if you don't stop, your turn will come. And if you help runaway inflation to come, you may find your carefully planned insurance income brings dollars worth no more than German marks in 1920. *It took a million marks to buy a loaf of bread.*

TO HELP LIFE INSURANCE DOLLARS AND ALL OTHER DOLLARS DO THEIR JOB, Do *These Three Things:*

Encourage our representatives in Washington to tax our extra income away. Hard, but it's easier than inflation, and saddling our children with War's cost.

Follow the price control rules. They can hold down the cost of living—but they won't work unless everyone helps.

Save—Invest in War Bonds... for America's post war future and your own. One form of saving, life insurance, does double work, for many premiums are invested in Government bonds. The amazing thing about life insurance today is that the more of it we all buy, the more the dollars from it will be worth tomorrow.

ROGERS

DIESEL AND AIRCRAFT CORPORATION

1120 Leggett Avenue, New York 59, N.Y. Builders of diesel-electric equipment and aircraft parts for our armed forces. *Divisions:* Hill Diesel Engine Company, Edwards Company, Edwards Aircraft Products, Inc., Ideal Power Lawn Mower Company.

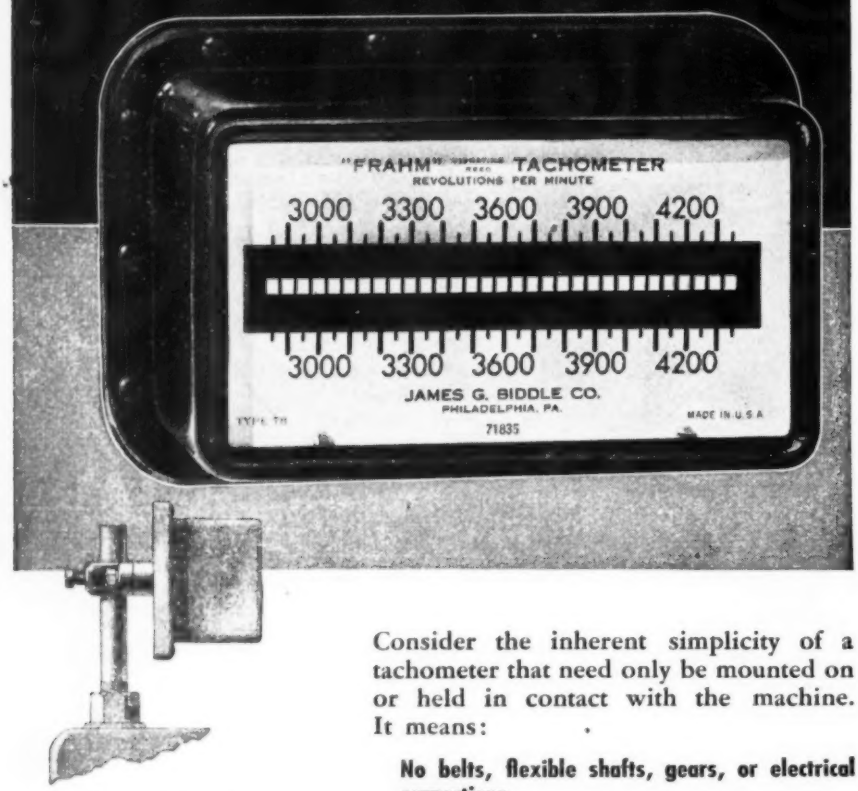
Diesel Engines, 5 to 2000 h.p. » Gasoline Engines » Generator Sets » Generators » Power Units
Switchboards » Pumping Units » Hydraulic Aircraft Equipment » Recoil Mechanisms » Power Mowers
Power Brushes » Snow Removal Equipment » Streamlined DeLuxe Railway Motor Trains » Diesel Locomotives

TRADE MARK REG.

COMPLETE REPRINTS of this message for poster use will be supplied upon request, subject to the limits of our paper allotment.

THE "FRAHM" VIBRATING REED TACHOMETER...

...is Simple as ABC



Above: Showing one method of mounting the Frahm Tachometer.

Below, left: Frahm Hand Tachometer.

Below, right: Frahm Permanent Mount Tachometer.

Consider the inherent simplicity of a tachometer that need only be mounted on or held in contact with the machine. It means:

No belts, flexible shafts, gears, or electrical connections.

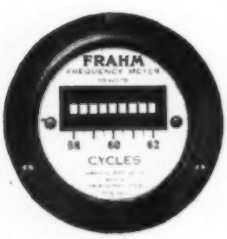
No lubrication required; No maintenance.

Independence from any outside source of power.

And the Frahm Tachometer is as accurate as it is reliable. It functions faithfully without attention year after year because there are no delicate parts—no springs, jeweled bearings, pivots, weights, magnets or connecting wires—nothing except a set of steel reeds, accurately calibrated and suitably mounted.

Furnished in stationary and portable types . . . for use on turbines, generators, motors, blowers, centrifugal pumps, Diesel-electric installations, etc. Various ranges available from 900 to 30,000 r.p.m.

For a complete description of Frahm Tachometers, together with list of types and ranges commonly supplied, write for Bulletin 1590-P.



"FRAHM" VIBRATING-REED FREQUENCY METERS—operate on the same unique principle as Frahm Tachometers, except that reed vibration is produced electrically instead of by direct mechanical contact. Unaffected by wave form or ordinary temperature changes. Switchboard, portable and miniature types in various ranges from 10 to 500 cycles per second. Write for Bulletin 1695-P.

JAMES G. BIDDLE CO. • 1211-13 ARCH STREET PHILADELPHIA 7, PA.

ous magnitude. This prevents the generators from feeding to the fault and avoids serious drops in generator voltage. Frequently an adjustable-time low-voltage relay is used in the control scheme to automatically drop all non-essential loads in emergencies, to maintain generator voltage and thus preserve essential service.

In the Nordberg plant, however, instead of opening the main incoming power-company breaker on outgoing fault current, the system is split at two inside points by tripping breakers No. 5 and 16, Fig. 3. This usually allows the power company to keep all east substation feeders alive without dropping load from the generator switchboard.

Directional relays in the control cubicle are actuated by energy from current and potential transformers associated with incoming breaker No. 1. This breaker is in the 13.2-kv switchhouse, Fig. 1, located about 300 ft from the main switchboard. An alarm sounds whenever the system splits, after which the outside power system is resynchronized through breaker No. 5 or 16. A further automatic feature prevents splitting the system when plant machines are not generating. This automatic control relieves operators of practically all worry during normal operation; they merely adjust for wattless current between the two power systems. Whenever anything unusual occurs, they have full control of the system from the control center, all essential breakers being dc-operated from a control battery in the main station. This control system is flexible and the operators can handle any emergency with a minimum delay.

Argument Corner

(Continued from page 124)

the nut with silver solder flux. We then melted off a small ball of silver solder, placed it inside the nut and held the arc on the stud until the solder melted and flowed down between nut and stud.

After the solder cooled it was surprising how easily the stud screwed out. The heat had loosened it in the threads and the nut provided a good hold to turn the stud. This is not the best method to melt silver solder, but it worked well in our case. We would have used a bronze welding rod, which could have been applied more easily than silver solder to connect the nut to the stud, but in these times we have to make use of what is available.

Brooklyn, N. Y. G STERLING GRAVES

(Continued on page 154)

"Captain Dag"

trace THIS FIGHTER'S RECORD BY HIS MEDALS!

If there were decorations for industrial heroes, Mr. Dag would be a much be-ribboned gentleman. Perhaps we should call him 'Captain' Dag, because he commands so versatile a company of physical and chemical properties.

Captain Dag (a campaigner who will never be mustered out) represents Dag brand colloidal graphite, the smooth, black liquid concentrate which serves so many different war industries. Capt. Dag may take the form of a dry film, a fluid film, a surface coating, an impregnation, etc.

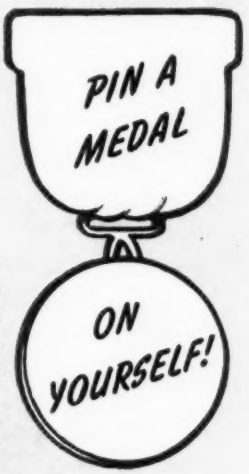
1, 3, 8, 14, 13, 6
CITATION: "We have been enthusiastic users of Dag colloidal graphite for more than ten years. We find it the only material which will prevent bolts, nuts and flanges from seizing under the high temperature and pressure conditions in our boilers and steam systems."

1, 3, 13, 14
CITATION: "Dry films formed from Dag colloidal graphite supply durable lubrication on parts which could not be effectively lubricated otherwise. Such films are functioning at temperatures from (—60° F. to +1200° F.) and higher."

PHYSICAL AND CHEMICAL PROPERTIES

1. Slippery—A Good Lubricant. Softer than Talc
2. Conducts Electricity
3. Withstands Temperature Extremes
4. Absorbs, Radiates and Conducts Heat
5. Maximum Purity
6. Low Coefficient of Expansion
7. Particles Bear Like Electric Charges
8. Insoluble in Acids and Alkalies
9. Black and Opaque
10. Gas Adsorbent
11. Little Photoelectric Effect
12. Miscible with Most Fluids
13. Films Adhere Tenaciously and Dry with Sharp Edges
14. Microscopically Fine Particles. Penetrates Fine Pores
15. An Excellent Suspension

2, 4, 13, 10, 11, 3
CITATION: "Graphite films when applied to the grids (and frequently the plates) of radio tubes for receiving and transmitting, are useful for minimizing secondary emission, 'back' emission and photoelectric effects."



For easy reference we've given colors to Captain Dag's most valuable properties. Match these colors with the performance "citations" above. Then pin a medal on yourself for putting Captain Dag to work in your plant. He's one campaigner who won't be mustered out.

Dag, Oildag, Aquadag, Castordag, Glydag and Prodag are registered trade marks of Acheson Colloids Corporation. Copr. 1944 by Acheson Colloids Corp.

dag COLLOIDAL PRODUCTS

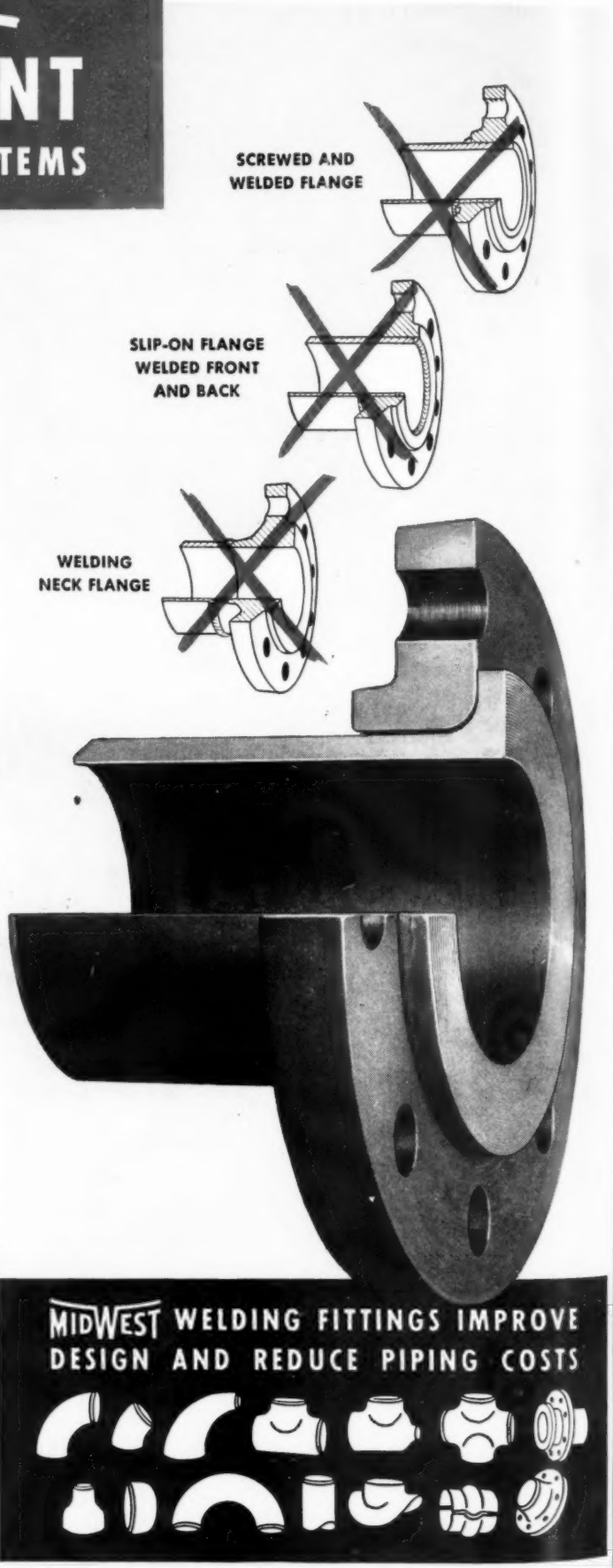
ACHESON COLLOIDS CORPORATION

PORT HURON, MICHIGAN

THE *Preferred* FLANGED JOINT FOR WELDED PIPING SYSTEMS

MIDWEST

LAP-JOINT STUB ENDS



For making connections to boilers, pumps, valves and other flanged outlets (and where piping must be frequently cleaned or inspected for corrosion), Midwest Lap-Joint Stub Ends have a tremendous advantage over flanges that are welded to the pipe (see drawings at right above). The swivel flange on the Stub End makes it unnecessary to accurately line up the bolt holes before welding; "setting up" is simple and quick because no special clamps or jigs are required to hold the face of the flange absolutely perpendicular to the axis of the pipe. The result is a real saving in time and cost of welding.

Another important economy is in erection. Field organizations report a saving of 25% in erection time for making up a joint using Midwest Lap-Joint Stub Ends in comparison with flanges rigidly fixed to the pipe; this saving is even greater when the flanges are on bends.

See Bulletin WF-41 for complete data regarding Midwest Lap-Joint Stub Ends . . . and the many other Midwest Welding Fittings that simplify and save on welded piping.

MIDWEST PIPING & SUPPLY CO., Inc.

Main Office: 1450 South Second St., St. Louis 4, Mo.

Plants: St. Louis, Passaic (N. J.) and Los Angeles

Sales Offices: Chicago—645 Marquette Bldg. • Houston—229 Shell Bldg. • Los Angeles—520 Anderson St. • New York—(Eastern Division) 30 Church St. • Tulsa—533 Mayo Building.

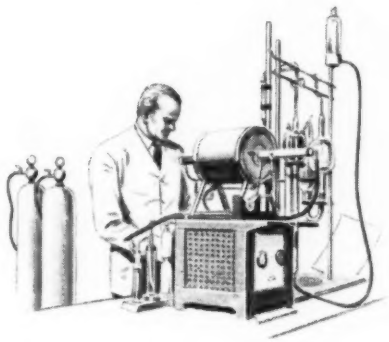
MIDWEST WELDING FITTINGS IMPROVE DESIGN AND REDUCE PIPING COSTS

BATTLE HELMETS
for the M-4s

The manufacture of special cast steel turrets for the M-4s is only one of many Continental Foundry and Machine Company's contributions to the war effort.

It indicates the complete facilities found at Continental for research, engineering and production of highest quality Carbon and Alloy Steel Castings of all types and specifications. It further accounts for Continental's pioneering leadership in the field.

Today Continental's 4 well located plants at East Chicago, Wheeling and Coraopolis are dedicated first to war production, then to meeting the requirements of industry. Offices: Chicago, Pittsburgh.



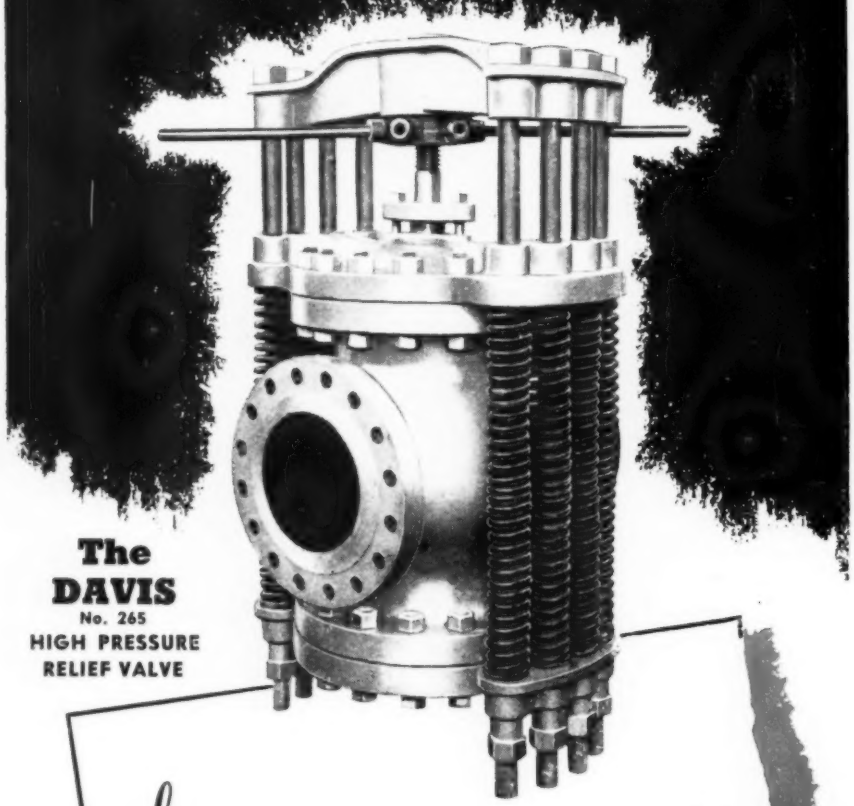
Fully equipped, modern laboratories and advanced engineering is your assurance of quality in every Continental product.

CONTINENTAL FOUNDRY & MACHINE COMPANY

FORMERLY CONTINENTAL ROLL & STEEL FOUNDRY COMPANY

Specializing in Carbon and Alloy Steel Castings for the following: Shipbuilding, Railroad Equipment, Machinery, Cranes and Shovels, Electrical and Hydraulic Equipment, Mining Machinery, Power and Hydraulic Presses.

A VALVE THAT WILL INTEREST EVERY POWER ENGINEER



The DAVIS No. 265 HIGH PRESSURE RELIEF VALVE

for:

- Turbine relief on bleeder system.
- Protection of any boiler room or process equipment by relief to atmosphere.
- Relief of high pressure lines to low pressure lines at predetermined pressure.
- Plants carrying multiple boiler pressures to protect lower pressure systems.

The Davis No. 265 High Pressure Relief Valve, an exclusive Davis design offers numerous features of advantage:

1. Multiple springs — less spring accumulation — less buildup for maximum relief—less blowdown to close.
2. Requires appreciably less head room because of compact design with springs located at sides.
3. Center adjusting screw provides quick, easy change of pressure setting.
4. Can be supplied with test lever.
5. Available with hold open device.
6. Available in semi-steel or steel with bronze or stainless steel trim.
7. Size range 4" to 30".

DAVIS REGULATOR CO.
2540 S. Washtenaw Ave. Chicago, Ill.

DAVIS VALVES

DAVIS REGULATOR COMPANY

Cause of Corrosion

IN JAN, 1944 POWER, Alex Higgins says in "Questions and Answers," that "corrosion is an eating away of the surface of plates, tubes and rivets or stays by acid impurities in the boiler feedwater." While this is true to the extent that all acids in feedwater are highly corrosive, it is improbable that with modern practices of feedwater treatment corrosive acids would be tolerated. Corrosion is primarily and almost always caused by the presence of free oxygen entrained in the water. Briefly, it is explained thus:

Iron, in contact with water where free hydrogen is present, has a tendency to go into solution. In so doing, it makes room for itself by forcing the hydrogen out of solution. As the hydrogen has no where else to go, it forms in a layer on the metal, or "plates out."

Now, we know that oxygen has a liking for hydrogen and will combine with it at every opportunity. It is in this connection that free oxygen in feedwater plays an important part in the corrosion of boiler metal.

When the free oxygen combines with the hydrogen coating, it quickly strips the protective layer from the metal surface and encourages further interchange of iron and hydrogen. More iron then goes into solution. This action continues until all free oxygen in the water is used up. Thus, it is apparent that although the tendency of iron to go into solution is the "cause" of corrosion, presence of free oxygen in the water is the controlling factor.

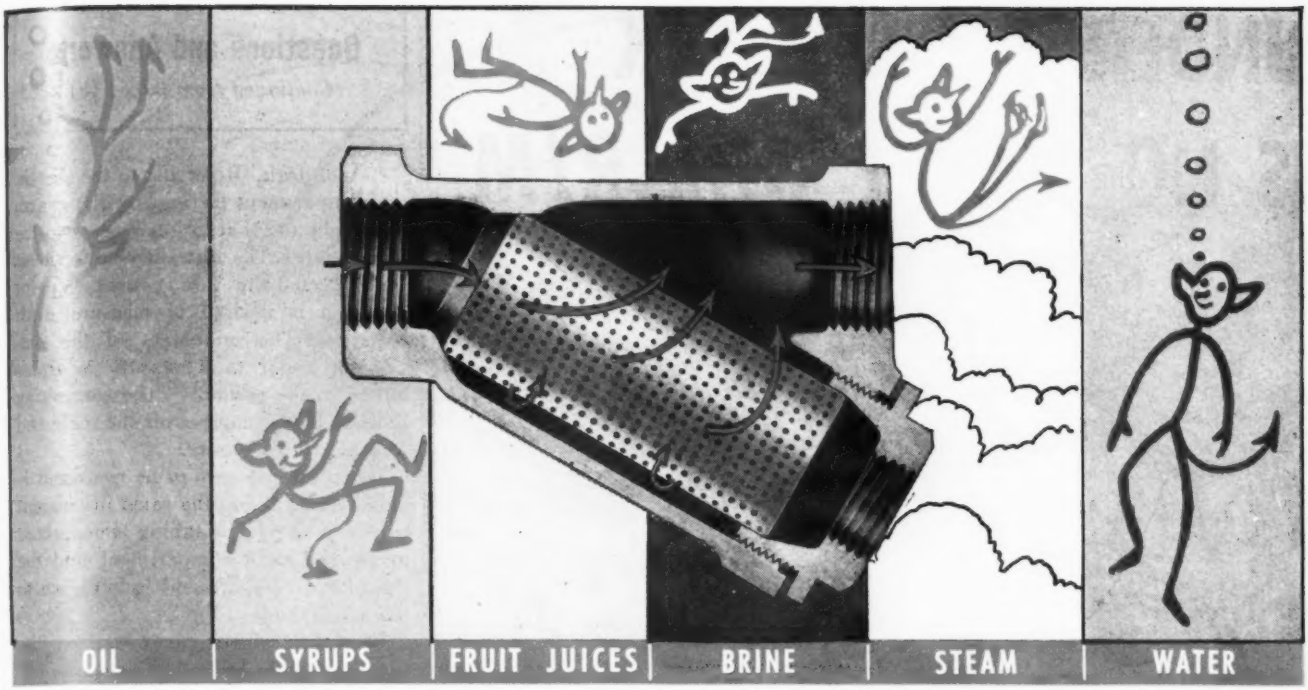
In smaller plants, best preventive step in removing oxygen from feedwater, thereby preventing corrosion, is the open heater, well vented, with an entering feedwater temperature of about 208 F. This usually reduces amount of oxygen to what is considered a harmless quantity. In larger installations, a deaerator is best.

Philadelphia, Pa. JAMES S HAMILTON

Soap Causes Trouble

IN ALL PROBABILITY soap in the boilers causes BTF's trouble (Jan. 1944, Readers' Problems). If he examines the various processes in the dye house and finishing departments, he will find the point where it might possibly enter the steam line. Here are two ways to prevent soap reaching the boilers: (1) Discharge the condensate from steam traps to waste and (2) install vacuum breakers at the highest point and near the end of each steam main.

Leaksville, N. C. TYCHO NISSEN



Prevent Work Stoppage with Sarco Strainers

Scale and dirt carried in pipe lines cause many costly shut-downs and expensive repairs which could have been prevented by the use of a simple pipe line strainer.

The liberal use of strainers ahead of reducing or regulating valves, pumps, meters, burners, lubricators, or nozzles will pay handsome dividends by maintaining production uninterrupted.

Follow the example of hundreds of equipment manufacturers who make sure of strainer protection by including one with every unit they ship.

Sarco Pipe Line Strainers cost but a few dollars to install and will outlast the equipment they protect against clogging or damage.

Available in sizes ¼" to 8", for all fluids and pressures.

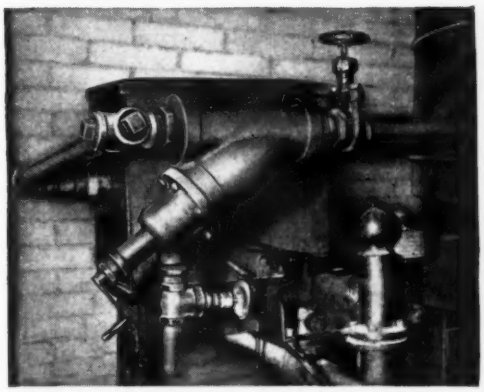
The Sarco Scraper Strainer, hand or motor operated, is recommended where interruption of service for strainer cleaning must be avoided.

Full information in Catalog No. 1200.

Sarco Strainer

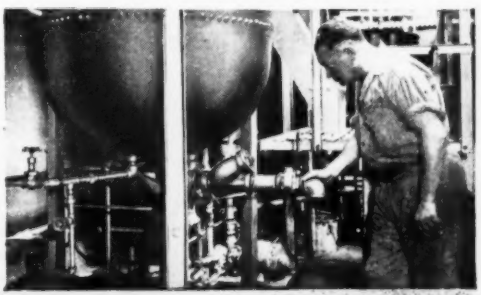
Sarco Scraper Strainer

THE SARCO STRAINER



Sarco Scraper Strainer in varnish plant

Sarco strainer on syrup cooker



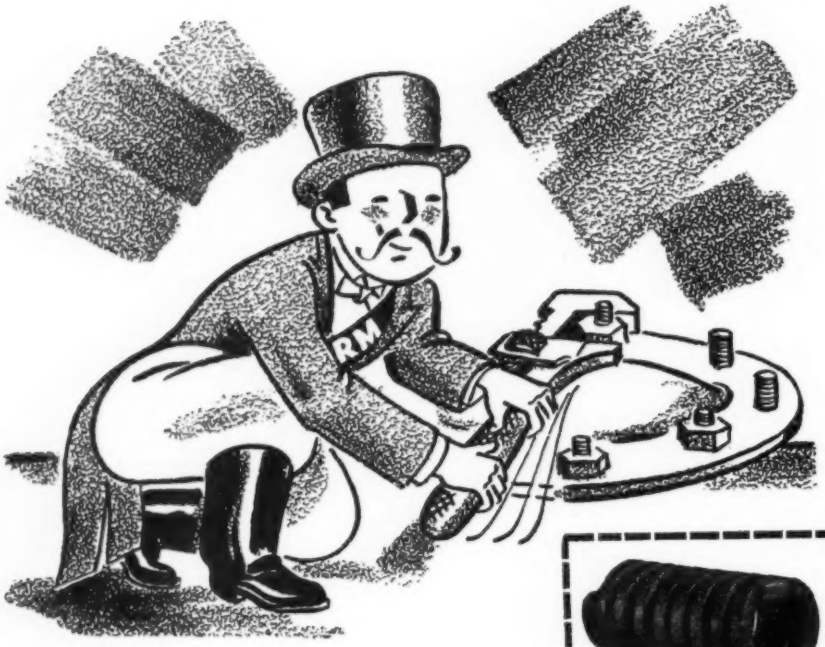
SARCO COMPANY, INC.
475 FIFTH AVENUE NEW YORK 17, N. Y.

Represented in Principal Cities

SARCO Saves Steam

SARCO CANADA, LTD., 85 Richmond Street, West, TORONTO, ONTARIO

UNDERCOVER WORK IS NO SECRET *with* R/M



Terrific pressures under the forced drafts of war-production call for tough gaskets and packings. R/M performance under this strain is no secret. Their extra margin of safety has saved hundreds of hours of replacement-time in America's race for the tools of war.

High-priority demands are absorbing the greatest production in R/M history. All the packings and gaskets we can make go to meet a vital need. If your requirements are vital, too, we'll do everything possible to serve you through your regular mill-supply house.

INDUSTRIAL SALES DIVISION
RAYBESTOS-MANHATTAN, INC.
MANHEIM, PA.
BRIDGEPORT, CONN. NORTH CHARLESTON, S. C. PASSAIC, N. J.
Makers of Packings for Every Industrial Use

Questions and Answers

(*Continued from page* 118)

inches of draft. Referring to the sketch, the compartment to right of diaphragm is airtight and that to left is open to the atmosphere. The airtight compartment is connected by tubing to the point where it is desired to measure draft pressure. The movement of the diaphragm under this pressure is transmitted to the pointer by the connecting links so that it moves over the scale and indicates the pressure.

When the pressure to be measured is below atmospheric the same instrument can be used but the tubing is connected to the left-hand compartment and the right-hand compartment is left open to the atmosphere.

Recording draft gages act on the same principle as indicating gages but the end of the pointer carries a pen which is in contact with a moving chart.

Metal expanding bellows, Bourdon tubes made in single tube, spiral- and helical-tube forms, sealed oil columns and mercury columns operating floats are also used as pressure elements in indicating and recording draft gages.

Q 16—Where is draft usually measured, and how are draft gages connected to the furnace or gas passages?

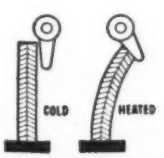
A—Gages may be connected and draft measured at any point between the ashpit and the chimney bottom. Where gages are permanent, use at least two, one showing draft over the fire and one, draft at the last pass of the flue gases. Fig. 6, page 118, shows one method of connecting a draft gage to a brick setting. A pipe is inserted in the wall and cemented to prevent leakage. A plugged tee is placed on the outer end of this pipe to provide a connection for the draft-gage tubing and a means of cleaning the large pipe if it should become plugged with soot or ashes.

Power News

(*Continued from page* 130)

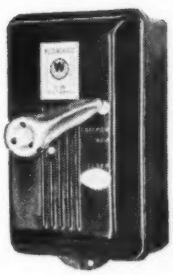
and the successful manufacture of this type of pump (Hydroseal) giving satisfactory operation in many installations. Allen's Hydroseal pump, the special features of which have been patented by him, is provided with a supply of clean flushing water between rotating impeller and stationary side plates to prevent entry of abrasive materials into

Wild arcs tamed *Quick!*



CALLING THE TRICK is the job of this Westinghouse Bi-metal Element. Two metals which react differently to heat are bonded together. Threatening overloads cause the Bi-metal to bend, tripping the interrupting mechanism and opening the circuit—*before* any damage is done.

TAMING THE ARC is the job of the "De-ion" arc quencher. It consists of parallel metal plates in the form of a grid. The arc is drawn into the quenching chamber . . . divided into segments . . . smothered between the plates—in the space of a half cycle.



When current's on the rampage, a circuit breaker has to function *fast* and *sure*—every time!

Westinghouse "De-ion" Circuit Breakers are built for just such hair-trigger protective action. They pass harmless overloads without interruption, but let danger threaten, and quicker than a blink of the eye—the circuit's opened . . . the arc is quenched. Burns and pits are minimized; contacts stay cleaner, last longer.

Once the disturbance is cleared, service is instantly restored by a flip of the indicating handle. No waiting—no repairs—no parts to replace.

Protect equipment and circuits with Westinghouse "De-ion" Circuit Breakers. Ratings up to 600 amperes; enclosures for nearly every type of service. Call your Westinghouse Representative today. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., Dept. 7-N.

J-21298

Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

"DE-ION" CIRCUIT BREAKERS

Herein lies a Story of SIMPLER • SURER • MORE ECONOMICAL Condensate & Air Removal

COE DRAINATORS

This is the kind of advanced steam trap you would expect to find available in these days of remarkable industrial progress.

Like many other modern devices its principal feature lies in its ability to function at high efficiency for uncommonly long periods with freedom from frequent maintenance attention and costly repairs.

In various industries, under widely differing conditions, thousands of Drainators are rendering greatly appreciated, high calibre service in the removal of condensate, air and non-condensible gases.

You won't appreciate its exceptional features until you try one.

Model M-41-S Drainator

For better handling of your smaller condensate loads there is this smaller, lower priced 1/2" tapped Drainator with magnetic indicator that can be installed on either side.

The COE MANUFACTURING Co.
501 BANK ST., PAINESVILLE, OHIO

DRAINATOR • THE ADVANCED STEAM TRAP

Write for a copy of Bulletin No. 903-A or ask us to send an engineer to discuss your condensate handling problems.

these spaces. By this means, the initial high efficiency and initial discharge are maintained for a far greater period than in former types of pumps for handling abrasive solutions."

The Longstreth Medal has been awarded every year since 1890 for meritorious work in science and arts. Among those who have received it are Thomas A Edison, Noiseless Typewriter Co and Elmer A Sperry, Jr. The Franklin Institute of the State of Pennsylvania for the Promotion of the Mechanic Arts was founded in 1824 and is today one of the world's most famous institutions devoted to the advancement of science and the promotion of the mechanic arts. It is the oldest institution of its kind in the United States and, as its name implies, its desire is to "do honor to Benjamin Franklin."

Fuel-Conservation Slogan

Fuel-Saving Starts With CONTROL

National committee of the automatic control industry starts campaign to save fuel in industrial plants by better application of combustion and other automatic controls. Committee will collect and disseminate technical information for operators.

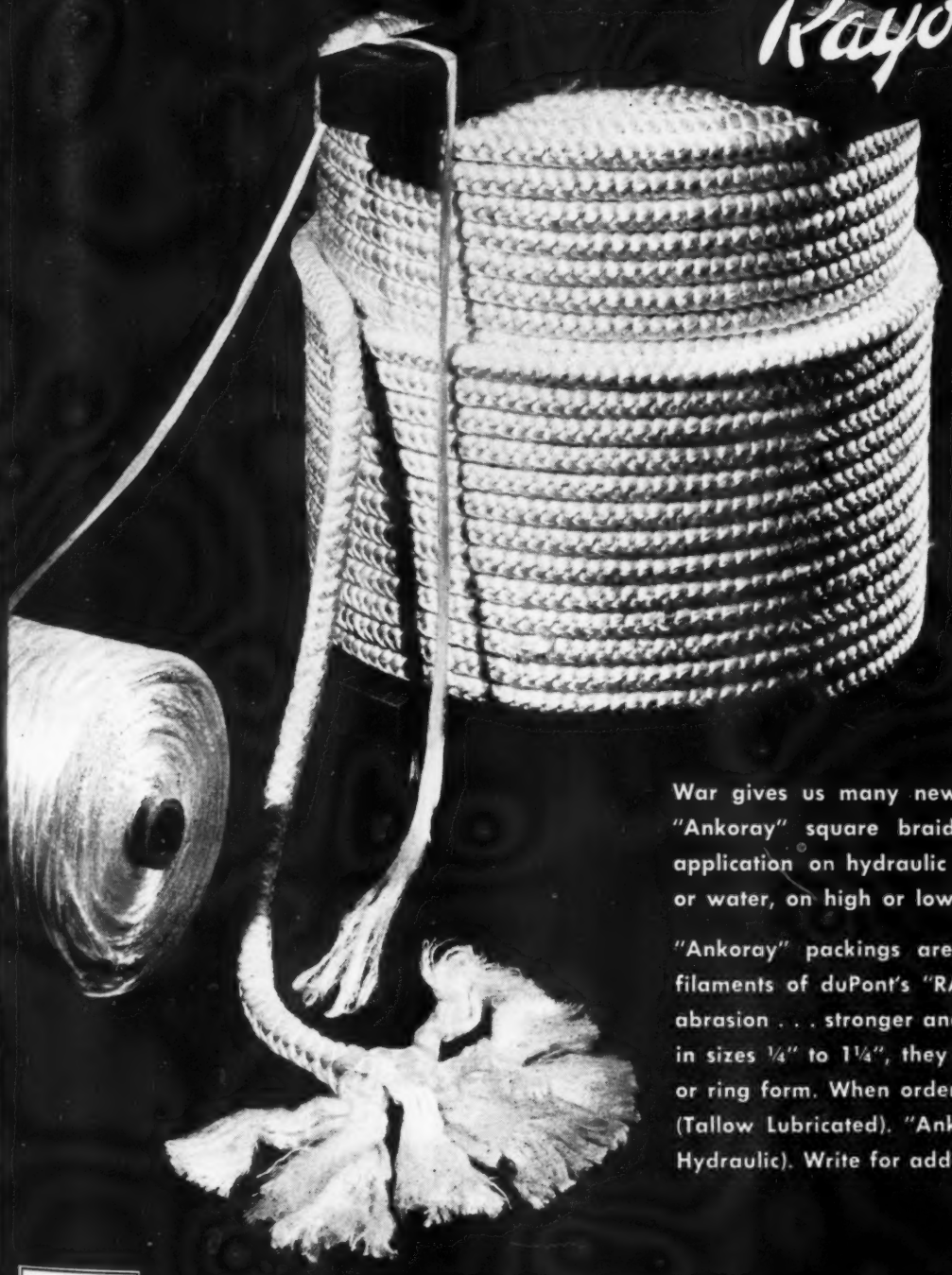
COAL OUTLOOK

The recent British Government order, which cut industrial users of electricity by 10% and of gas by 25% because of the coal shortage resulting from extended walkouts, would be handled in this country under order L-94, if a similar situation arose. Curtailment here would prescribe electricity for refrigeration for air conditioning; heating of transit cars; interior- or exterior-sign, show-window, showcase, ornament, outline, decorative, advertising, night-sports, white-way and excessive commercial lighting. Further curtailment could be made on stipulated industrial users.

Substantial coal savings in the New York area were effected recently by WPB's aluminum and magnesium div when it halted production on two pot lines operated by Aluminum Co of America at its Queens plant. Both lines had operated at capacity, around 72,000,000 lb yearly, and decrease in electric-energy use through coal savings will be about 500,000 tons.

A bulletin, showing quantitatively the effect of variables that determine final accuracy of analysis of a coal sample, contains hitherto unpublished data on coal sampling and float-and-sink tests from the

"Ankoray" PACKING FABRICATED FROM "Rayon Fiber"



THE ANCHOR PACKING CO. TRADE A MARK

War gives us many new and better products. The new "Ankoray" square braided packings are finding wide application on hydraulic equipment working against oil or water, on high or low pressures.

"Ankoray" packings are made from strong, continuous filaments of duPont's "RAYON No. 126" . . . are low in abrasion . . . stronger and softer than rawhide. Fabricated in sizes ¼" to 1¼", they are furnished on reels or in coil or ring form. When ordering specify "Ankoray" No. 332-T (Tallow Lubricated). "Ankoray" No. 332-WPH (Waterproof Hydraulic). Write for additional information.

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Greater COMPRESSOR CAPACITY IN SMALLER OVERALL SPACE!

It makes no difference what your power plant requirements for compressed air are, large or small, you will find that Schramm's compact air compressors will give you plenty of air . . . all you want . . . anywhere you want it in your plant! Schramm compressors give you these advantages: 100% watercooled to prevent freezing or overheating . . . mechanical intake valve operating from cam in perfect timing . . . larger discharge valve with lower lift adding to efficiency . . . furnished either for belt drive or "built-in" motor drive, assembled rigidly and in perfect alignment.

For Full Details—Write NOW!

SCHRAMM INC.

THE COMPRESSOR PEOPLE
WEST CHESTER
PENNSYLVANIA

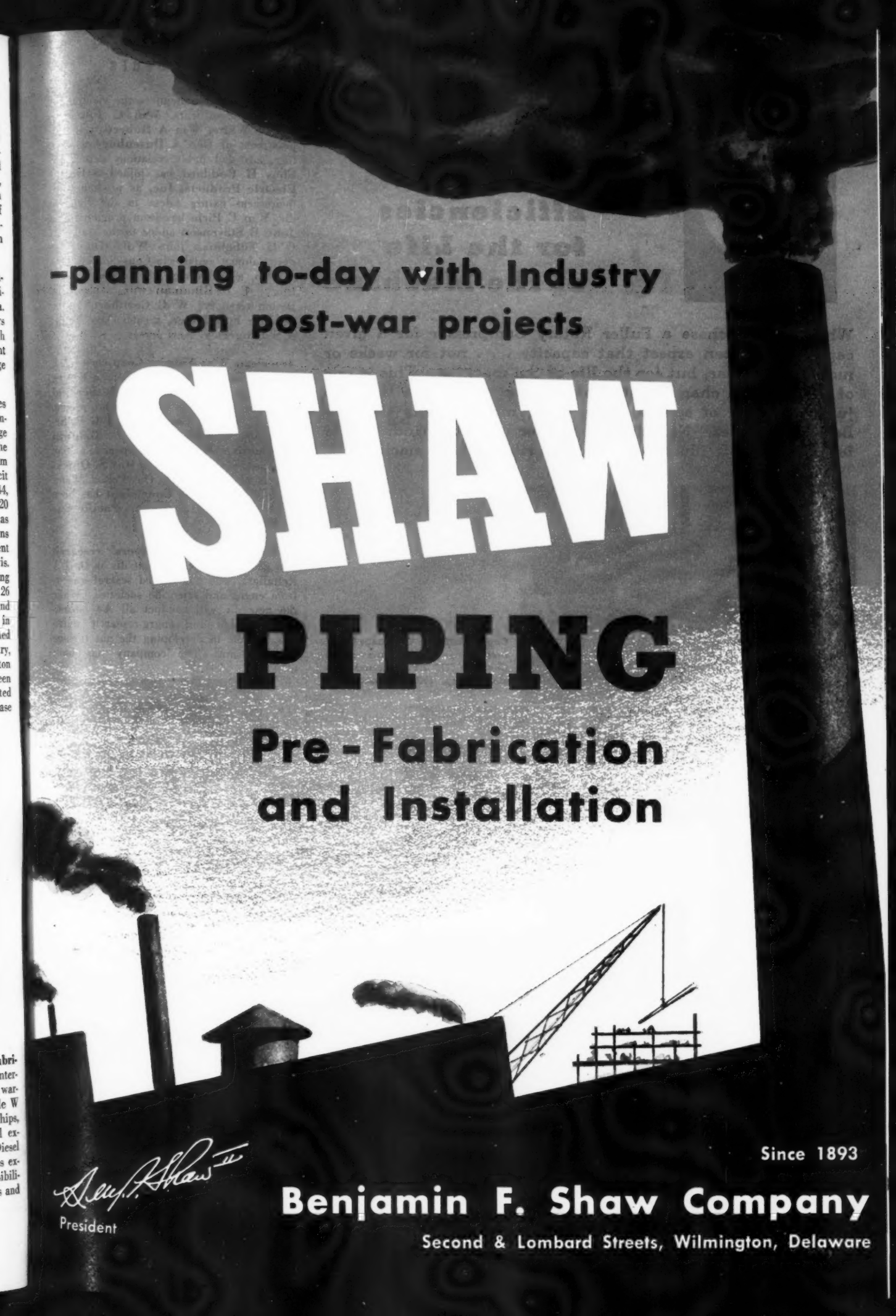
Pittsburgh Coal Co, Battelle Memorial Institute and **Bureau of Mines.** Variables are: (1) those related to the degree of heterogeneity of the coal at sampling point, such as average ash content of the coal, degree of ash segregation in the unmined bed, mixing operations in transit, size distribution of pieces, (2) those that depend on superimposed sampling actions—that is, whether samples are taken at random or in an orderly way. For a copy of Bureau of Mines Bulletin 454, order by name, "Fundamentals of Coal Sampling," for 20¢ from Supt of Documents, Washington, D. C.

To conserve dwindling coal and manpower, two new systems have been instituted at Fulton Gas Works, Richmond, Va. Instead of burning coal exclusively, boilers are being equipped to burn tar, or both products simultaneously. This equipment is a result not so much of the coal shortage as of its irregular delivery.

WPB Chairman Donald Nelson urges all possible stockpiling by industrial consumers because of an anticipated shortage between 25 and 45 million tons during the coal year started April 1. Solid Fuels Adm has long predicted a 20-million-ton deficit in bituminous coal production for 1944, based on estimated requirements of 620 million tons. The picture looked bright as long as miners brought 12½ million tons above ground weekly under the settlement negotiated last fall by Ickes and Lewis. Since then, drafting fathers and canceling occupational deferments for men under 26 cut output to 12 million tons or less and threatens to cut it further. An increase in 1944 railroad coal requirements, combined with extra coal for the electric industry, would more than use up the 10-million-ton increase in 1944 coal requirements foreseen by SFA. Other industrial users, calculated on the same basis, would further increase this year's requirements.

Rear Admiral Earle W Mills

At SAE National Diesel-Fuels & Lubricants meeting, Chicago, May 17-18, interesting reports were made on essential wartime developments. Rear Admiral Earle W Mills, asst chief, Navy dept bureau of ships, regarded as Navy's outstanding diesel expert, spoke on "Some Horizons of Diesel Development." SAE Pres Wm S James expressed his views on "Post-war Possibilities of the SAE Diesel Engine — Fuels and Lubricants Activities."


-planning to-day with Industry
on post-war projects
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and Installation
President
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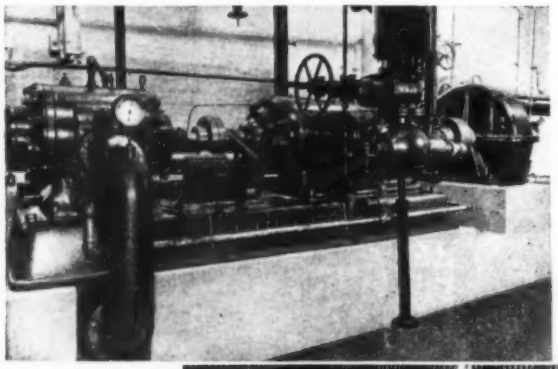
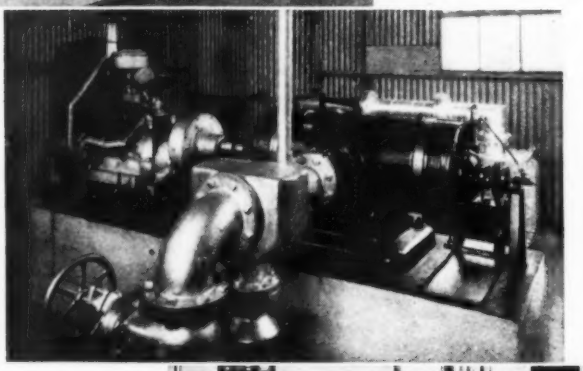
FULLER ROTARY COMPRESSORS

Continuous, Maintained Efficiencies for the Life of the Machine

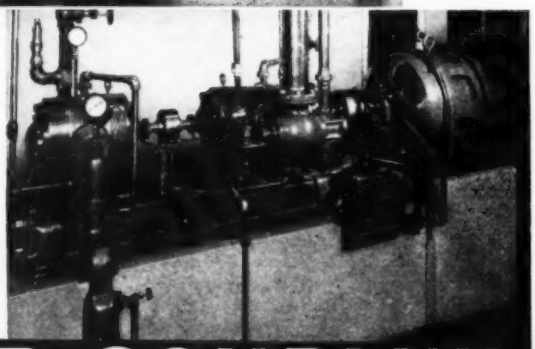
When you purchase a Fuller Rotary Compressor for a given capacity, you can expect that capacity . . . not for weeks or months or a year, but for the life of the machine. This is one of the inherent characteristics of a Fuller . . . they're built for just that kind of service. Only three moving parts: Rotor—Bearings—Blades. No valves to leak or seats to grind. Write for Bulletin C-5, illustrating and describing these machines.



Copper Refinery: Two-stage Compressor, geared turbine drive. Capacity 1775 C.F.M. actual free-air delivery, 100-lb. pressure.



Gas Industry: Single-stage Compressor, gas-engine drive. Capacity 756 C.F.M. actual free-air delivery, (1,088,640 cu. ft. per day).



Valve Mfg. Plant: Two-stage Compressor, motor drive. Capacity 191 C.F.M. actual free-air delivery, 125-lb. pressure.

C-97

FULLER COMPANY
CATASAUQUA—PENNSYLVANIA
CHICAGO, 3 Marquette Bldg. WASHINGTON, 5, D.C. Colorado Bldg. SAN FRANCISCO, 4 Chancery Bldg.

Appointments

Allis-Chalmers announces the election of three vice-presidents, **Wm C Johnson, Jas M White, Wm A Roberts,** and appointment of **Geo A Dusenbury** as asst mgr, adv and public relations dept . . . **Chas H Goddard** has joined **Sylvania Electric Products, Inc,** as product mgr, fluorescent fixture sales; in the lighting div, **Wm C Pirie** has been promoted and **John B Stevenson** added to the staff . . . **G H Tobelman** joins **Wolverine tube div,** Calumet and Hecla Consolidated Copper Co, as sales mgr of the eastern territory; **C E Rinaman** will manage the Boston territory; **W C Gernhart,** Philadelphia; **F R Meier,** greater New York; **A S Kingerley,** New Jersey.

American Wire Fabrics Corp elects **B L Weaver** a vice pres . . . **McCulloch Engrg Corp** appoints **Donald A Sutherland** field engr in charge of sales and promotion . . . **Perfex Corp** names **I G Bohrman** mgr of radiator div . . . **Baldwin Locomotive Works** has opened a San Francisco office in charge of **Ray S. Quick,** who is also genl mgr, The Pelton Water Wheel Co . . . **H H Courtright** has been named mgr, San Joaquin div, **Pacific Gas & Elec Co.**

Manager of Allis-Chalmers' research and gas-turbine-development div is Dr J T Rettaliata, who has earned several awards from engrg and scientific societies. While the new div will conduct all A-C steam-turbine-design and engrg-research activities, its role in developing the gas turbine is significant. The company has built

nearly 30 gas-turbine units for oil refineries, and has had experience in production of the aircraft supercharger version of the gas turbine.

Allan B Hendricks, Jr, who designed the first million-volt testing transformer equipment in **GE's Pittsfield Works,** has retired after 43 years service . . . **Leonard J Moore,** for 13 years executive engr, San Joaquin power div, **Pacific Gas & Elec Co,** has retired because of illness . . . **R L Tomlinson,** 21 years mgr, marine dept, **Carrier Corp,** has resigned because of ill health.

J H Hagenguth, Genl Elec Co, is now a member of Am Standards Assn committee on **sphere gap standards** . . . **A J Tigges** is mgr of consulting engrg for all divisions

SECTION 6000
Of Catalog 37, Pages 6001 to 6036
January, 1944
Replacing Section 6000, dated April, 1939 and Section 6200, dated March, 1942
Busways and Wireways
SAFLEX FEEDER DUCT
SQUARE-Duct
SAFLEX PLUG-IN DUCT
ELECTRICAL EQUIPMENT • KOLLSMAN AIRCRAFT INSTRUMENTS
SQUARE D COMPANY
DETROIT • LOS ANGELES HOUSTON

NOW—IS THE TIME TO MODERNIZE ELECTRICAL DISTRIBUTION SYSTEMS

In the face of today's manpower shortage, peak efficiency of electrical distribution systems is vital. It will be equally important in the highly competitive and narrow-margin years ahead.

"Busways and Wireways" illustrates and gives complete data on Square D's complete line of distribution duct. Send for your free copy—and if you have a specific problem in electrical control and distribution, your nearest Square D Field Engineer will be glad to give you sound counsel.

MAIL THE COUPON FOR YOUR FREE COPY OF "Busways and Wireways"

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Please send my copy of *"Busways and Wireways"*

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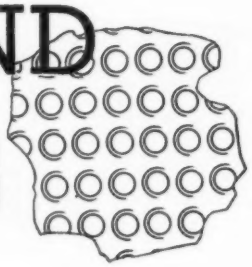
ELECTRICAL EQUIPMENT • KOLLSMAN AIRCRAFT INSTRUMENTS

SQUARE D COMPANY

DETROIT • MILWAUKEE • LOS ANGELES

PLENTY OF FERRISUL NOW TO PREVENT SCALE AND FOAMING



PREVIOUS shortages have been overcome and Ferrisul is again available in ample quantities wherever a versatile, effective coagulant is required for boiler feed water to prevent scale, foaming, and similar dangers to efficient heat transfer.

Ferrisul (anhydrous ferric sulfate) is effective over the entire pH range above 3.5. Its floc is highly adsorptive... forms immediately... settles rapidly... *and leaves no dangerous scale-forming or corrosive residuals.*

Because Ferrisul is a dry, free-flowing, granular material, it is easy to handle... requires no expensive storage tanks ...can be transferred on any standard conveyor system... and can be introduced into the system in standard dry feed machines or solution feeders. It can also be used with either hot or cold process softening.

For further details and the names of consulting water chemists prepared to prescribe and supply Ferrisul, write: MONSANTO CHEMICAL COMPANY, Merrimac Division, Everett Station, Boston 49, Massachusetts.

MONSANTO CHEMICALS
SERVING INDUSTRY...WHICH SERVES MANKIND

and subsidiaries, **Baldwin Locomotive Works** . . . **J K Gannett** has been named director of engrg and research, **The Austin Co** . . . **Dr V N Krivobok,** metallurgical authority, joins development and research div, **The International Nickel Co** . . . **Philip J Ehman** has been named asst research director, **Ansul Chemical Co** . . . **Cardox Corp** has appointed **J Paul Oliver** administrative technical asst, research div; **Dr Lawrence M Liggett,** plant superintendent; **Dr Jas A Taylor, Dr Winfred L Norem** and **John L Ballard** chemical engineers, research div.

The Foxboro Co has named **Chas Schwarzler** mgr, export dept . . . **Alexander M Hamilton** has been appointed vice-pres, foreign sales, **Am. Locomotive Co.** . . . **Industrial Unit Heater Assn** has elected for the ensuing year: **N Downey,** pres; **C E Scott,** vice-pres; **L O Monroe,** secy-treas . . . **Propeller Fan Mfgrs Assn** has elected for the coming year: **E C Englert,** pres; **Wallace Allen,** vice-pres; **V C Shetler,** secy-treas . . . **H P Munger** is plant mgr of two Olean, N. Y. plants of **Van der Horst Corp** . . . **John D Spalding** has been named works mgr, superior engine div, **National Supply Co, Springfield, O.**

Ford W Harris has been appointed engr, **Union Water Power Co,** Lewiston, Me . . . **John L Collins,** plant engr with Central Main Power Co, has been elected vice-pres, **Maine Assn of Engrs** . . . **Ralph F Prescott** has been appointed chief engr, West Water St steam plant, Taunton, Mass., Municipal Light Dept . . . **H E Bixby,** Portland, Ore., is chief, regional branch of power utilization, U. S. Bur of Reclamation, **Central Valley Project.** Following consolidation of **Los Angeles Water and Power Bureaus, C P Garman** is chief electrical engr; **W S Peterson,** design and construction engr; **Clayton M Allen,** office engr; **G E Benkesser,** engr of station design.

The Laclede-Christy Clay Products Co begins its second century of service this year. It was founded in 1844.

Robert S Coffin

Bailey Meter Co announces that E G Bailey, former president and founder has been elected chairman, while **Robert S Coffin** succeeds him as president. Mr. Coffin has been with the company since its organization in 1916.

NICKEL AIDS THE AUTOMOTIVE INDUSTRY

to KEEP 'EM ROLLING!

Using ingenuity and "know-how" born of long experience, automotive engineers designed the phenomenally successful transport equipment that now speeds the United Nations on the road to Victory.

Built to take punishment far above peacetime requirements, these specialized military vehicles are being produced in quantity by the mass-production methods that have amazed the world. From North Africa to the South Pacific, these trucks, jeeps, tanks and half-tracks have repeatedly met demands for stepped-up performance.

This kind of engineering-thinking pioneered the application of Nickel alloyed materials. Now, when uninterrupted operation is so vitally important, the widespread use of Nickel is clear evidence of its many advantages.

In steering knuckles or differentials, in forged gears or cast blocks, a little Nickel goes a long way to provide essential dependability. It improves strength/weight ratios, increases wear and corrosion resistance, imparts toughness, and assures uniform properties of the metals with which it is combined.

Today, maintenance crews on far-off battle fronts are learning what metallurgists and engineers here long have known . . . that, properly used, Nickel aids to "keep 'em rolling."

For years the technical staffs of International Nickel have been privileged to cooperate with automotive engineers and production men . . . men whose work is now so necessary to the Nation. Counsel, and printed data about the selection, fabrication and heat treatment of ferrous and non-ferrous metals is available upon request.

New Catalog Index

New Catalog C makes it easy for you to get Nickel literature. It gives you capsule synopses of booklets and bulletins on a wide variety of subjects—from industrial applications to metallurgical data and working instructions. Why not send for your copy of Catalog C today?

★ Nickel ★

THE INTERNATIONAL NICKEL COMPANY, INC., *67 Wall St., New York 5, N. Y.*

THE BLACKOUT THAT *Prevents* A BLACKOUT!

PLUS-FIFTY DUGAS Dry Chemical works amazingly fast in "blacking out" fires in electric power equipment. But equally important, PLUS-FIFTY DUGAS Dry Chemical kills fire without injuring vital equipment not already damaged by fire.

Bringing new fire-fighting speed when speed counts most, PLUS-FIFTY DUGAS Dry Chemical also offers a new degree of safety because its greater fire-smothering action means reduced danger from flash-backs. And PLUS-FIFTY DUGAS Dry Chemical is a non-conductor of electricity.

Want the complete story of PLUS-FIFTY DUGAS Dry Chemical as well as priority information on DUGAS Fire Extinguishing Equipment? Write today for quick service.

Approved by Underwriters' Laboratories and Factory Mutual Laboratories.

PLUS-FIFTY duGas REG. U. S. PAT. OFF. DRY CHEMICAL U.S. PATENT

CHART showing comparative characteristics of all types of approved hand fire extinguishers, sent free on request.

MODEL 150 WHEELED EXTINGUISHER

DUGAS ENGINEERING CORPORATION, MARINETTE, WISCONSIN
OWNED AND OPERATED BY ANSUL CHEMICAL COMPANY

Nordberg Tests Largest Single-Acting Diesel

On May 1, Nordberg Mfg Co, Milwaukee, announced completion of tests on the most powerful single-acting diesel engine ever built in America. The unit tested, intended for direct-drive service on a Victory ship of the U. S. Maritime Commission, is of 6000-shaft hp, but the type is available in sizes from 4000- to 8000-shp, in 6 to 12 cylinders, for single or twin-engine direct drive, as well as for stationary applications from 3000 to 6000 kw.

The 6000-shp unit tested is good for 10% continuous overload and 25% for 2 hr. This 12-cycle single-acting crosshead mechanical-injection unit runs 160 rpm. Bore and stroke are 29 in. and 40 in. Scavenging is by centrifugal blower, motor driven.

A new $225,000 turbine and accessory equipment, which will boost capacity at the city power plant at Edmonton, Alta., from about 25,000 to 37,000 kva, has been given its first test run.

OBITUARIES

John C Brooks, 58, vice-pres and director, Monsanto Chemical Co and genl mgr of its plastics div, died en route from St. Louis.

Walter E Becker, southern regional manager, York Corp, died unexpectedly in Houston, Tex., Apr 10 at the age of 57.

Ernest Easthope, 91, founder with his brother of Easthope Bros, marine engine mfgrs, of Vancouver, Can., died recently.

Edw T O'Donnell, 74, retired city stationary engineer, died Apr 25 in Buffalo, N. Y.

Robt Chamberlain, 71, died in Vancouver recently. For 20 years he had been electrical engineer at the Capitol Theatre.

Frank J Cunneen, 53, Washington representative of Cochrane Corp, Nordberg Mfg Co and LeRoi Engine Co, died of a heart attack Apr 7.

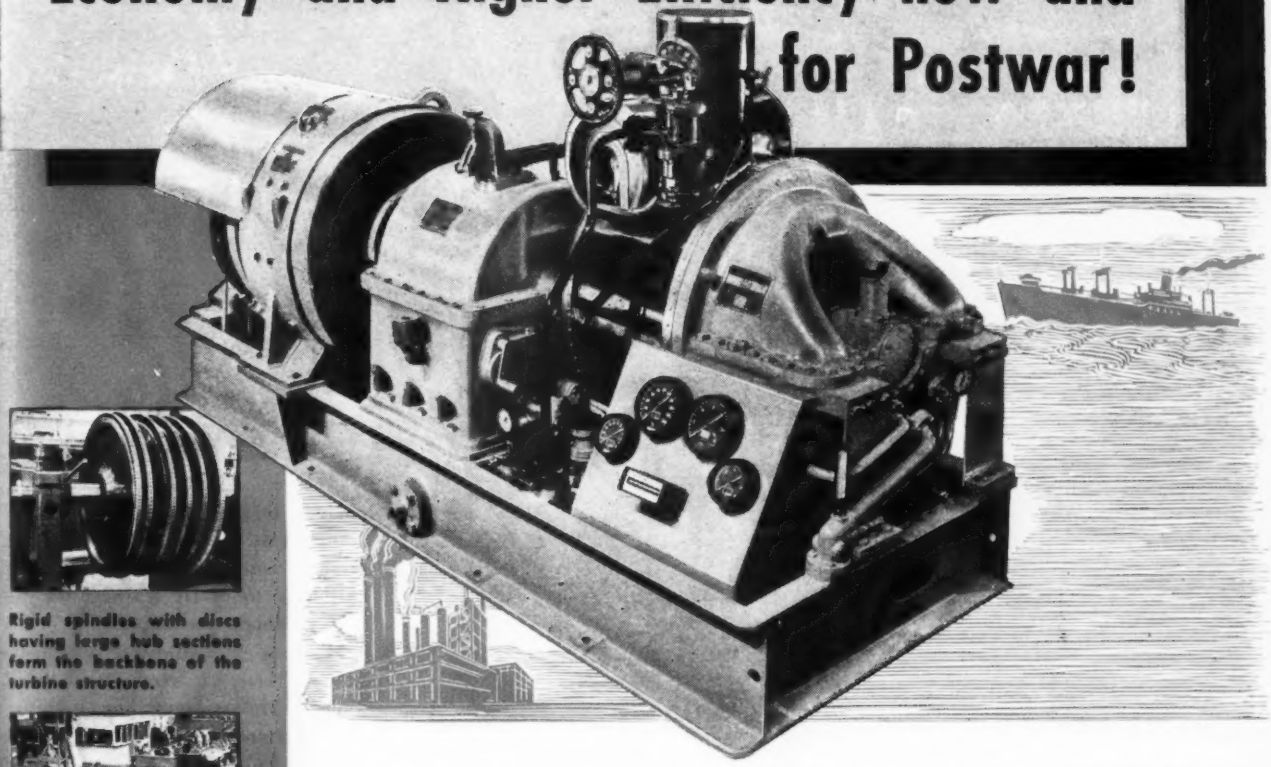
M E Thompson, electrical industry pioneer, inventor, and father of the compensated generator, died in Ridgway, Pa., Apr 5 at the age of 80.

Engineering Pioneer Dies at 77

George A Orrok, internationally known consulting engineer and honorary member of the ASME, died April 6, in Riverside, Conn., at the age of 77. He was with New York Edison Co (now Consolidated Edison) from 1898 to 1931, when he established an independent New York consulting office with David M Myers and W A Shoudy. At the time of his death he was a partner in the architectural-engineering firm of Binger-O'Connor-Orrok.

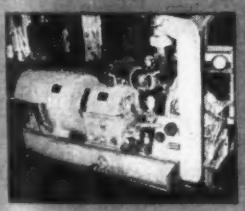
Hailed by power engineers every-

HENDY'S NEW TURBO-GENERATOR Assures Economy and Higher Efficiency now and for Postwar!



Rigid spindles with discs having large hub sections form the backbone of the turbine structure.

Production-line assembly of Hendy turbines is possible, through the application of exacting dimensional-control systems.



A portion of the extensive testing stands where exhaustive tests are given each Hendy Turbo-generating plant before it is marked "OK for shipment."

This smooth, compact Hendy Turbo-generator plant is built to the rigorous requirements of war service. Proving its economy of operation and higher efficiency under today's exacting demands, it will be ready to serve in many marine and industrial uses of the postwar era.

Among the features that distinguish this new Hendy power plant are:

1. Fabricated steel reduction gear case encloses the oil pump, priming pump, governor and its power unit, and the high-speed pinion coupling.
2. New-type, simplified governing mechanism requiring no stuffing boxes or soft packing, insures closer speed regulation and uniform output.
3. Parts subject to normal wear or periodic inspection are designed for maximum accessibility to reduce time required for servicing.
4. Location of filters, strainers, coolers and controls eliminates much piping and increases over-all efficiency.

Hendy Turbo-generators can be built to your exacting requirements in a range of 250 to 750 kw. Larger ratings are being designed. Your inquiries are invited.

JOSHUA HENDY Division

JOSHUA HENDY IRON WORKS

SUNNYVALE, CALIFORNIA

EST. 1854

Branch Offices: BOSTON • BUFFALO • CHICAGO • CINCINNATI • CLEVELAND • DETROIT • NEW YORK • PHILADELPHIA • PITTSBURGH • SAN FRANCISCO • ST. LOUIS • WASHINGTON • LOS ANGELES

TURBO-GENERATORS

REDUCTION GEARS

STEAM TURBINES

DIESEL ENGINES

INTESTINES with Fortitude!

PTP

Seamless steel tubes are the intestines of the ship, the power plant, the oil refinery, the locomotive, and the chemical plant...delivering an ever-flowing flood of power to America's mighty production efforts.

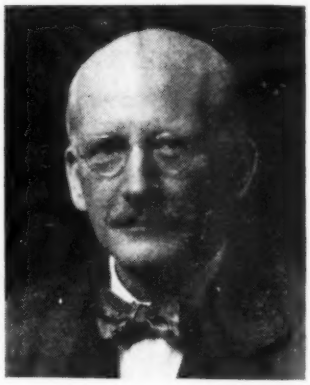
Seamless steel tube "know-how" is vitally necessary to keep those lines going steadily. Cold drawn seamless steel PTP tubing achieves accuracy to size and uniformity of gauge through exacting control and thorough inspection at every step in manufacture. Where cost is a factor, and seamless steel tubing required, PTP tubing offers an economical and satisfactory solution to the problem.

★ Official United States Navy photograph. Interior of a submarine —a maze of piping.

PIPE & TUBE PRODUCTS
INCORPORATED
Manufacturers of Cold Drawn Seamless Steel Tubing
JERSEY CITY, N. J. • WORKS: READING, PA.

where as a grand old man of their profession, he seemed to belong equally to the mining engineers and the "civils." George always said that a real engineer ought to be able to tackle any kind of a design or building job, and he acted accordingly.

Born in Dorchester, Mass., July 3, 1867, Orrok profited greatly from an



early mechanical environment. His father was a practical machinist, so young George quite naturally gained skill with tools. He learned to chip and file, and make castings.

Quitting the study of chemistry at MIT to save his eyes, Orrok tried his hand at almost everything, gaining useful experience at every step. He worked as molder, wheelwright, blacksmith, machine operator, railroad brakeman, school teacher, college professor. On the engineering side, he designed or built electric street railways, small steam and hydro power stations, cable railways, improved coal-mine hoists and ship-loading docks.

In 1898, he went to work for Van Vleck, a mechanical genius who had started with Thomas Edison in 1884 and had worked up to be consulting engineer for New York Edison. Orrok helped pioneer the change to ac generation and had a hand in the design of the famous Waterside Station.

During his many years with New York Edison, Orrok gained an international reputation for his promotion of high-pressure steam-table research and, earlier, for heat-transfer studies. For years he was a lecturer at Yale, Harvard, Princeton and Brooklyn Polytechnic. He was active in several engineering societies, notably the ASME, which he represented abroad on several occasions.

Recently, he had done special work for the Army and Navy, including a job at the Panama Canal.

He leaves a widow, Elene Geer Orrok; a son, George A. Orrok, Jr., of Boston; and a brother, Henry, also of Boston.

DUE TO A *Shoestring* PLANT POWER SYSTEM

INACCURACIES that result from eye strain often have an unsuspected *basic* cause—unsuspected because even good lamps and good lighting units can't prevent poor illumination if they are starved for voltage.

DIM LIGHT RESULTING FROM UNDERVOLTAGE near the ends of long feeders is a familiar symptom of antiquated plant power distribution. At the same time, excessive lamp burnouts because of *overvoltage* may be occurring in areas near the power entrance.

MANY KINDS OF POWER SUPPLY TROUBLE—affecting production equipment as well as lighting—are likely to be chronic when the plant distribution system has been extended, piecemeal, to handle loads it was never designed to supply. Makeshift switchgear, hand-me-down transformers, and long overloaded feeders may appear to be "getting you by." Until suddenly—like a shoestring—something snaps! Nurse them through for the moment if you must, but start planning now to replace them.

GENERAL ELECTRIC

HERE'S *News*

of modern electric power distribution—G.E.'s load-center system, which you can plan as a complete installation, and install block by block as you modernize or extend your plant.

VOLTAGE DROP (PER CENT)

0
5
10
15
20

EVERY FOOT OF FEEDER LENGTH

Heavy feeders required to carry low-voltage power long distances from the switchboard are eliminated by load-center distribution. With this modern system, power is distributed at relatively high voltage (2.4 to 13.2 kv) to load-center unit substations located near the centers of load areas. There it is stepped down to utilization voltage and distributed to the load through drawout air circuit breakers and *short* secondary feeders.

Change

VOLTAGE DROP (PER CENT)

0
5
10
15
20

SHORT FEEDERS MEAN FULL

ADDS TO THIS VOLTAGE SAG*

*This curve, and those below, are based on an assumed-constant voltage at the plant supply point.

Over to LOAD-CENTER POWER

You can do it a step at a time

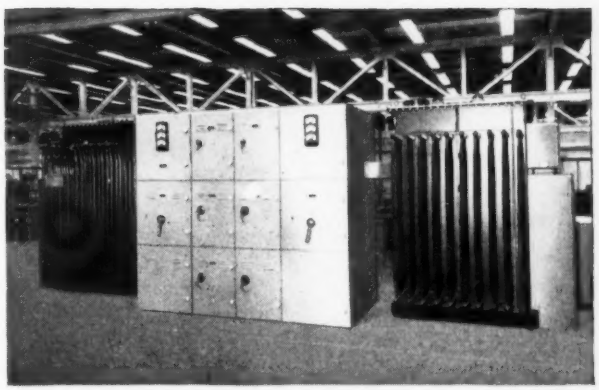
VOLTAGE SAGS, outages, and personnel hazards that are inevitable with outdated power circuits can best be eliminated by the use of load-center unit substations throughout your plant.

The great flexibility of load-center power enables you to make the right start without a complete changeover, all at one time, of your present electric power system.

- *To supply electric power to a new plant extension* requiring 200 kva or more, one or more unit substations can be installed to tie in with future modernization in older areas.
- *To eliminate a "trouble-spot" now served by long, overloaded feeders,* a high-voltage line to a new unit substation at the center of that load area will solve the immediate problem on a long-range basis.
- *To modernize a power system without interfering with production,* you can proceed step-by-step, switching over load areas one by one as more unit substations are installed. Eventually, you'll have the same fully co-ordinated system that would go into a new plant.

Before you make *any* additional investment in transformers, switchgear, or cable for piecemeal extensions or replacements, investigate the load-center system. General Electric engineers will help you decide on a *complete plan* of power-distribution modernization, so that every circuit you add, or every equipment purchase you make from now on, brings you closer to a fully co-ordinated load-center system.

GENERAL ELECTRIC



The load-center power distribution system for this industrial plant called for three double-ended unit substations, with Pyranol transformer sections, each located in a production area.

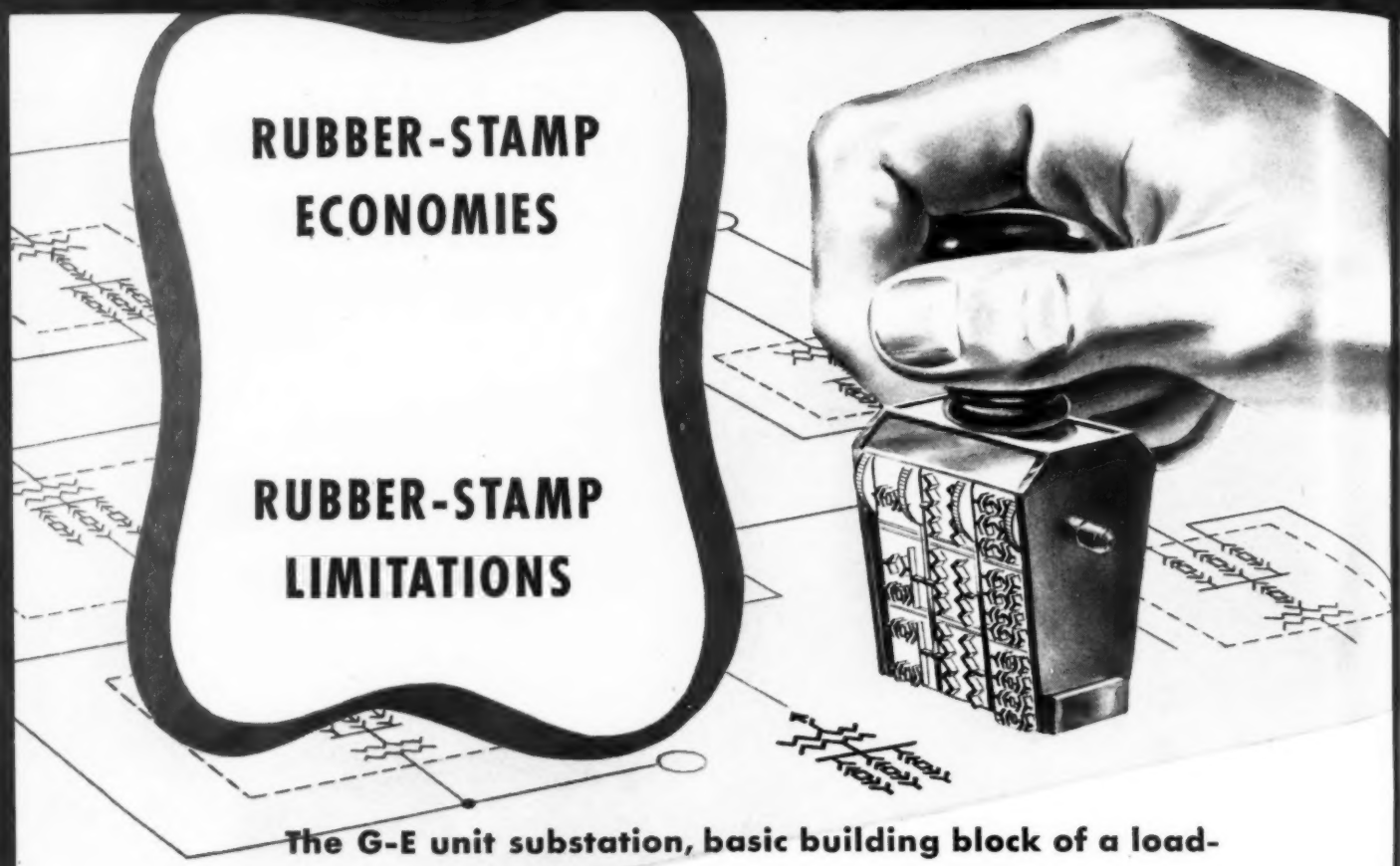
in Contrast

In contrast to a voltage drop of 10 to 20 per cent which sometimes occurs under full load in long secondary feeders (see chart at top of page), the voltage drop in a well-planned load-center system will seldom exceed 3 to 5 per cent (see below). Here's why: First, voltage drop is minimized by high-voltage distribution. Second, transformer-tap settings at each load-center substation are chosen to furnish full voltage required by the load in the local area. Third, low-voltage feeders are so short that voltage drop is negligible. There is no need to supply excess voltage to assure adequate voltage at the end of a circuit.

LL VOLTAGE ALL THROUGH THE PLANT

RUBBER-STAMP ECONOMIES

RUBBER-STAMP LIMITATIONS



The G-E unit substation, basic building block of a load-center system, meets *thousands* of user requirements with *relatively few* parts — all repetitively built

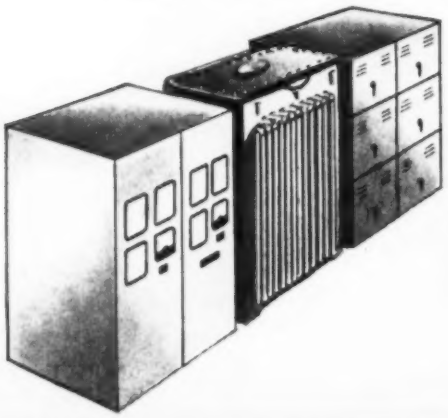
Whatever the power requirements of your plant, or of the load areas within it, G.E. can supply completely co-ordinated unit substations without the extra costs and delays for special design. Whatever the circuit arrangement you choose, a standard combination of incoming-line and secondary protection will meet it. These substations arrive ready to be set in place at the load centers. With a few simple connections, they are ready to go.

They are safely "at home" anywhere in the plant, thanks to the use of a Pyranol* or dry-type transformer section, and fully metal-enclosed switchgear.

In any power distribution system built around G-E unit substations, you can be sure that the interrupting capacity of the breakers is correctly matched to the transformer ratings.

For further information, ask your local G-E representative or write for Bulletin GEA-3758. *General Electric Company, Schenectady 5, N.Y.*

*Reg. U. S. Pat. Off.



The G-E standard-package load-center unit substation includes a safety-enclosed, drawout air circuit breaker equipment properly co-ordinated with a Pyranol transformer. Pyranol transformers, being noninflammable, permit installation indoors without vaults.

BUY WAR BONDS

LOAD-CENTER Power Distribution Systems

GENERAL ELECTRIC

302-29-5900

New Catalogs, Booklets and Bulletins to Bring Your Equipment Library up to Date

A WARTIME NECESSITY

We regret that paper limitations make it impossible to continue to use a heavy inserted sheet for this New Bulletins page and hence to furnish the customary business-reply cards.

The information in the bulletins and catalogs is, if anything, more valuable now than ever, and we believe that this offsets any slight inconvenience involved in using the coupons instead of the business-reply cards. Please read the new instructions carefully so that we may serve you promptly.

HOW TO ORDER

Each coupon orders one piece of literature. Use as many coupons as you need, but cut them out as a single block, regardless of the number of coupons needed to fill your order.

Be sure to fill out, completely, one of the eight coupons for *each* piece you order. (See sample at right.) This reduces amount of clerical work involved in handling your request, and helps to insure prompt receipt of items.

When you have filled out one space for each catalog or bulletin you want, cut the coupon block and put it in an envelope addressed to POWER, 330 West 42nd Street, New York 18, N. Y.

Write in circle number of item describing one catalog wanted → (17)

Your Company Name Brown Mfg Co

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Your Title Power Engineer

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Write in circle number of item describing one catalog wanted →

Your Company Name

Address

Your Name

Your Title

POWER, 330 West 42nd St., New York 6/44

AIR COMPRESSORS AND ACCESSORIES

1 GAS ENGINE COMPRESSORS — Worthington Pump & Machinery Corp, Harrison, N. J. 26-page bulletin No. L-690-B1 describes LTC angle two-cycle gas engine compressors for gas or air-lift pumping, gasoline plants, refineries, gas transportation lines, repressuring, refrigeration plants, sewage works, pressure maintenance and for general air supply.

2 AIR COMPRESSORS—Schramm, Inc, West Chester, Pa. 6-page catalog No. 4215 covers Model No. 60 compressor, in various mountings, for engineering and construction fields, railroads and small industrial installations.

3 AIR COMPRESSORS — Worthington Pump & Machinery Corp, Harrison, N. J. 4-page bulletin No. H-620-B21C gives engineering data on single-stage and two-stage tank-mounted *Feather Valve* air compressors.

4 AIR COMPRESSORS — Worthington Pump & Machinery Corp, Harrison, N. J. 8-page bulletin No. L-667-B1 features two-stage motor-driven direct-connected belted YC *Feather Valve* compressors. YC compressor size list is included.

5 AIR COMPRESSORS — Sullivan Machinery Co, Michigan City, Ind. 56-page bulletin shows installations of heavy-duty two-stage air-cooled compressors; gives description of available sizes, types, drives and construction detail; also information as to foundation requirements, regulation, accessories and servicing.

6 GAS EXHAUSTERS AND BOOSTERS—Roots-Connersville Corp, Connersville, Ind. 16-page bulletin No. 32-33-B-12 discusses advantages, operating principle, design and construction features, installations and applications of rotary positive gas exhauster and booster line.

7 AIR COMPRESSORS—Schramm, Inc, West Chester, Pa. Single-sheet bulletin No. 4320 contains combinations, specifications, dimensions, weights and prices of Model No. 20 compressors.

AIR CONDITIONING, HEATING, REFRIGERATION AND VENTILATING

8 GAS PURGERS—Armstrong Machine Works, Three Rivers, Mich. 8-page bulletin No. 160 describes Armstrong non-condensible-gas purgers for removing air and other non-condensibles from refrigerating systems.

9 SPRAY NOZZLES—Spraying Systems Co, 4021-S W Lake St, Chicago 24, Ill. 32-page catalog No. 22 gives spray characteristics, dimensions and performance data on complete standard spray nozzle line. Also described are special purpose nozzles and accessories.

BOILERS AND AUXILIARIES

10 BLOWOFF SYSTEMS — Cochrane Corp, 17th and Allegheny Ave, Philadelphia, Pa. 12-page bulletin No. 4081 explains classes of Cochrane continuous blowoff systems, their applications and advantages.

11 FEEDWATER REGULATION — Northern Equipment Co, Erie, Pa. 34-page textbook, 6th Edition, entitled "Mechanical Feed Water Regulation for Boilers," covers principles of boiler feedwater control and describes mechanical equipment available to meet various operating conditions. Differential pressure control and feed pump control are also discussed. Contains numerous illustrations, diagrams and chart reproductions.

12 CO_2 INDICATOR—Bacharach Industrial Instrument Co, 7000 Bennett St. Pittsburgh 8, Pa. 4-page bulletin No. 341 covers Fyrite instrument operation. Also described is the Bacharach fire efficiency finder, which correlates stack temperature and CO_2 to show total preventable stack loss in heating efficiency percentages.

13 SINGLE-GAS-PASS BOILER — Dept M, Foster Wheeler Corp, 165 Broadway, New York 6, N. Y. 28-page bulletin No. B-44-5 on S-A boiler consists of an assemblage of drawings and photographs, together with operating data of a number of well known plants. Method of operation and photographs showing construction are included. Chart gives heat content of steam.

14 OIL BURNERS—York Oil Burner Co, York, Pa. Series of bulletins covers York-Heat horizontal rotary oil burners. Iris shutter, a feature of these burners, is also discussed.

15 SHUTOFF VALVES — York-Lalor div, York Oil Burner Co, York, Pa. Leaflet gives operation, description of parts, prices and specifications of standard York-Lalor automatic shutoff valves for fuel oil.

16 HIGH-PRESSURE BOILER UNITS —York Oil Burner Co, York, Pa. Single page bulletin No. 40042 outlines York-Heat boiler-unit parts and auxiliary equipment. Boiler-unit specifications are also included.

CONTROLS, ELECTRIC

17 ENGINE CONTROLS — Synchro-Start Products, 221 E Cullerton St, Chicago 16, Ill. 52-page 1944 catalog describes company's standard automatic and semi-automatic engine controls.

18 CAM PROGRAM TIMERS — Automatic Temperature Control Co, 34 E Logan St, Philadelphia 44, Pa. 4-page catalog No. B7 describes ATC cam timers for controlling sequence and duration of a series of three or more individually-timed machine or process operations. For metal-working, chemical-process, petroleum-refinery and food-processing industries, cam program timers are also for timing consecutive or overlapping functions of electrically actuated valves, signals or machinery.

CONTROLS, MECHANICAL

19 COMBUSTION CONTROL EQUIPMENT—Engineer Co, 75 West St, New York 6, N. Y. 12-page bulletin No. BD-44 explains importance of simple combustion control. Enco steam-pressure regulator, balanced-draft regulator and stoker-speed control are discussed.

20 COMBUSTION CONTROL—Leeds & Northrup Co, 4934 Stenton Ave, Philadelphia 44, Pa. 40-page catalog No. N-01M-163 presents some recent installations of company's full-metered system of combustion control.

All literature designated with a star (★) may be obtained only by writing direct to the manufacturer on company letterhead, giving writer's name and title.

★ METAL BELLOWS—Cook Electric Co, 2700 Southport Ave, Chicago 14, Ill. 44-page catalog gives principles, construction and engineering advantages of *Spring-life* bellows, as well as other Cook bellows products. Booklet also explains purpose, organization, services and products of New MetaLastic div. Free copy only to executives, purchasing agents and engineers.

ELECTRICAL EQUIPMENT

21 INSULATORS AND FITTINGS — Porcelain Insulator Corp, 451 E Main St, Lima, N. Y. 12-page catalog on Pinco standard insulators and fittings shows units which can be supplied under Schedule V, WPB Limitation Order L-154, of June 29, 1943.

22 SYNCHRONOUS MOTORS—Electric Machinery Mfg Co, Minneapolis 13, Minn. 4-page publication No. 173 illustrates construction and engineering design of coupled, pedestal-bearing synchronous motors, with minimum ratings of approximately 300 hp, 500 rpm and higher. Synchronous motor control is also discussed.

23 ELECTRICAL EQUIPMENT CARE —Square D Co, 6060 Rivard St, Detroit 11, Mich. 28-page booklet, entitled "Care and Maintenance of Electrical Equipment," contains instructions for keeping switches, panelboards and switchboards in good operating condition. Also contains a parts-ordering list of Square D electrical equipment.

24 DIRECT-CURRENT MOTORS — Century Electric Co, 1806 Pine St, St. Louis 3, Mo. 12-page booklet, Form No. 3421, describes construction of Century direct-current motors, in sizes from 1/6 to 300 hp.

25 POWER CENTERS—Dept. 7-N-20, Westinghouse Electric & Mfg Co, East Pittsburgh, Pa. 26-page booklet No. B-3224 discusses Westinghouse power centers, which are compact, coordinated unit substations available in all standard ratings. Booklet suggests standard arrangements to fit various distribution systems.

26 LATCHES AND DRAWINGS — I-T-E Circuit Breaker Co, 19th and Hamilton St, Philadelphia 30, Pa. 4-page bulletin No. 4312 explains deadcenter and overcenter latch design. Latches are not only for circuit breakers, but for such equipment as automatic machinery and safety devices. 4-page bulletin No. 4311 outlines advantages of three-dimension pictorial drawings of switchgear and in depicting shape and part relationship in one view, in planning manufacturing and assembly operations and in taking place of models. Drawings are also for determining clearances and possible interferances and in training new employees.

MAINTENANCE AND SAFETY EQUIPMENT

27 CUTTING TOOLS—Haynes Stellite Co, Kokomo, Ind. 16-page pamphlet, Form 2991, is an enlarged edition of a previous folder. Sizes and prices of Star J-Metal round tools have been added to more complete data on standard square, rectangular and tipped tools. List of standard milling cutter blades has been extended; information is detailed on tool holders and adaptors that can be made for use with Star J-Metal; and sizes, prices and descriptions of alloy wear strips are included.

28 SOLDERING COMPOUND — Metallizing Co of America, 1330 W Congress St, Chicago, Ill. Single page bulletin No. 17 contains applications, directions and general information on new Mogul flux.

29 FIRE EXTINGUISHING SYSTEMS —Cardox Corp, Bell Bldg, Chicago 1, Ill. 8-page bulletin summarizes engineering, performance and outstanding features of Cardox fire extinguishing systems, which utilize low-pressure carbon dioxide.

30 MACHINE-TOOL ACCESSORIES — Machinery Products div, Ideal Commutator Dresser Co, 1290 Park Ave, Sycamore, Ill. 12-page booklet, Form No. MTC-943, covers company line of magnetic chucks, triple-duty live centers, etcher-demagnetizers, metal etchers, portable demagnetizers, electric tachometers, grinding-wheel dressers, balancing ways, variable speed transmissions and electric cleaners.

31 TOOL REPAIR—Handy & Harman, 82 Fulton St, New York 7, N. Y. 16-page bulletin No. 14, entitled "How to Repair Broken Cutting Tools with Easy-Flo," gives examples of its actual application to a variety of cutting tools.

32 CARBIDE TOOLS—Tungsten Carbide Tool Co, 2661 Joy Rd, Detroit 6, Mich. 4-page bulletin No. 44-1 covers company's revised line of single-point diamond-ground carbide tools. Complete specifications and prices are listed.

33 CHROMIUM-TUNGSTEN CUTTERS —Haynes Stellite Co, Kokomo, Ind. 8-page booklet, Form No. 5350, entitled "Operating Information on Stellite 98M2 Cobalt- Chromium-Tungsten Turning and Boring Tools and Milling Cutters," explains cutting angles, speeds and feeds, chip-breaker grinds and grinding wheels for Stellite 98M2 turning and boring tools and milling cutter blades.

MAINTENANCE MATERIALS

34 GEAR LUBRICANTS—E F Houghton & Co, 303 W Lehigh Ave, Philadelphia 33, Pa. Booklet describes gear lubrication problems and their correct handling. Various gears are discussed and illustrated, together with proper lubricants for gear sets, headstocks, open gears and worm gears. General instructions on proper lubrication maintenance are also included.

MATERIALS HANDLING

35 CAR PULLERS—Jeffrey Mfg Co, Columbus 16, Ohio. 4-page bulletin No. 774 covers specifications, capacity, dimensions and advantages of Jeffrey *All Purpose* car pullers.

36 SKIP-HOIST LOADING GATES—C O Barlett & Snow Co, Cleveland 5, Ohio. 4-page bulletin No. 92 describes company's new plug-feed skip-hoist loading gate. Photographs, engineering diagrams and a table, giving dimensions of eleven standard sizes, are included.

37 STORAGE AND HANDLING EQUIPMENT—Nicholson Co, 10 Rockefeller Plaza, New York 20, N. Y. Folder, entitled "Eliminating the Aversion to Conversion," gives reasons for converting to coal and benefits derived from Nicholson boiler-house storage and handling equipment.

38 WIRE-ROPE SLINGS — John A Roebling's Sons Co, 640 S Broad St, Trenton 2, N. J. 72-page catalog contains data on wire rope and grommet slings and also new *flatweave* sling. A section of book is on wire rope fittings, which are used with slings.

39 MATERIALS-HANDLING EQUIPMENT—Robins Conveyors, Inc, Passaic, N. J. 28-page booklet presents facilities, operations and products of company. Many photographs of plant and products are included.

40 STORAGE AND BULK HANDLING —Nicholson Co, 10 Rockefeller Plaza, New York 20, N. Y. 36-page bulletin, entitled "Storage Must Be Streamlined," provides a pictorial account of company's diversified installations in 20 industries.

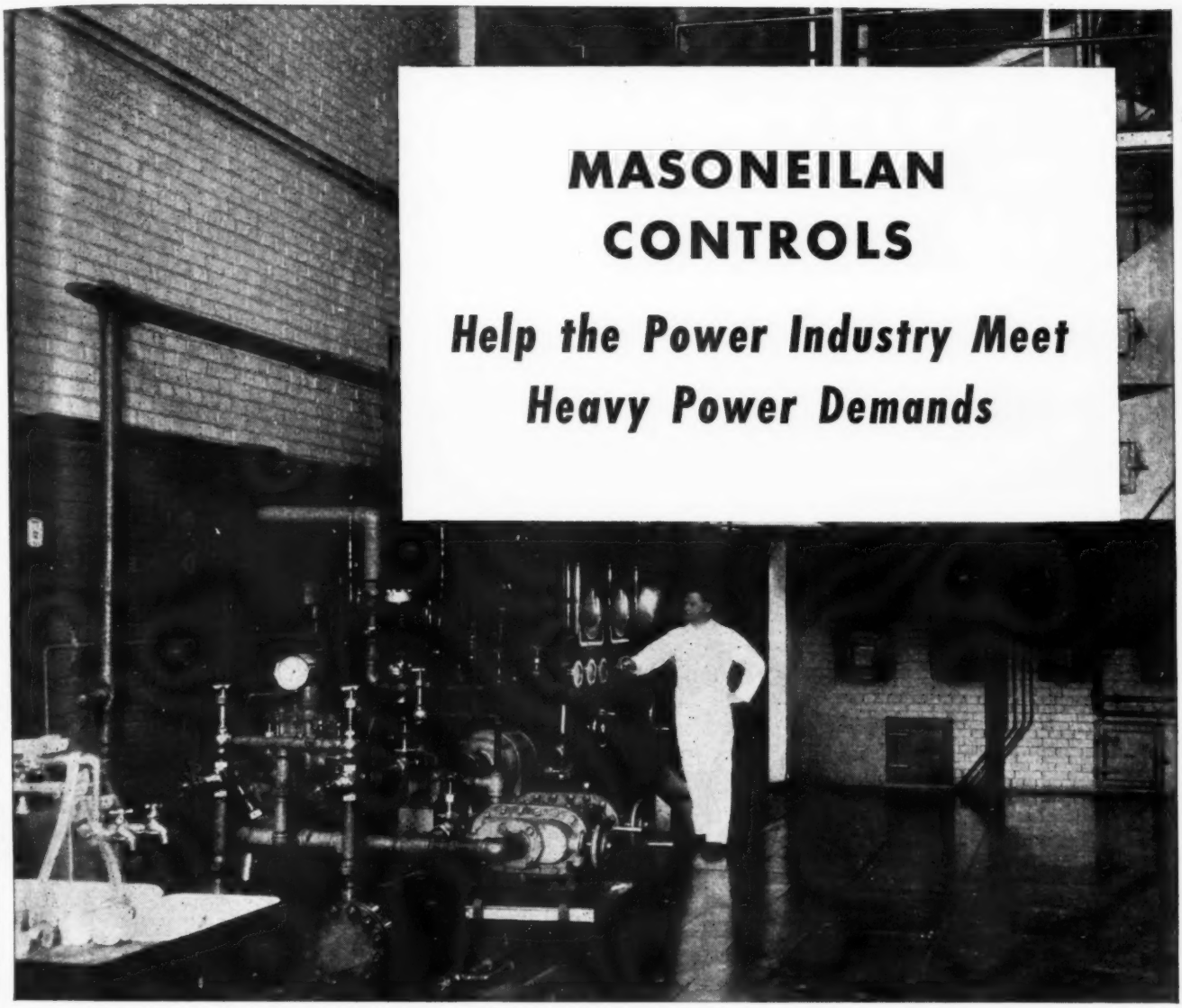
41 CONVEYOR SYSTEMS — Robinson Air-Activated Conveyor Systems, 205 E 42nd St, New York 17, N. Y. 4-page bulletin No. 310 gives materials which can be handled, advantages and installation list of Robinson air-activated conveyors. Schematic diagram shows some of the possibilities in company's conveyor-system application.

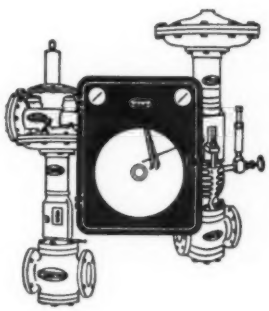
42 ASH-HANDLING EQUIPMENT — Hydro-Ash Corp, 343 S Dearborn St, Chicago, Ill. Catalog describes different disposal systems and also gives factors that determine which type to use. It lists such methods as disposal directly into trucks, or sluice systems, to fill vacant land or carry the ashes to a suitable pit.

(*Continued on page* 174)

MASONEILAN CONTROLS

Help the Power Industry Meet Heavy Power Demands





TODAY, power plant engineers are doing a great job in meeting the peak-load demands required by war industries . . . And in hundreds of plants, Masoneilan Control Equipment—such as pressure regulators, temperature controllers, flow meters, indicators and recorders—is helping by providing accurate, reliable and dependable control under all operating conditions.

A portion of our equipment is now available for maintenance and replacement for other than war industries. Write for information and catalog 71.

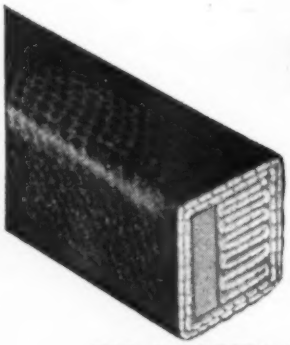
MASONEILAN

MASON-NEILAN REGULATOR COMPANY

1186 ADAMS STREET, BOSTON 24, MASS.

New York Philadelphia Pittsburgh Toledo Chicago Tulsa Atlanta St. Louis Houston
Los Angeles San Francisco Mason Regulator Co. of Canada, Ltd., Montreal, Canada

BELMONT PACKINGS



FOR RECIPROCATING STEAM RODS

Belmont 30

For reciprocating steam rods where boiler temperature is in excess of 100 lbs. (340 degrees F.)

FOR ROTATING SHAFTS

Belmont 754 P

For all types of centrifugal and rotary conditions, as well as oscillating rods.

FOR STEAM

Today, the war demands uninterrupted service of power plant equipment. Engines and pumps must be kept operating at maximum capacity—there is no time for frequent packing replacements.

Leaking valves . . . pistons . . . rods and plunger cause power losses which cut serious inroads into production.

Check now the packing in your stuffing boxes—at points of service—at prime movers—put the right packing on each job to avoid unnecessary delays through equipment failures.

Above we illustrate two standard Belmont Packings for steam services. Belmont High Pressure Packing No. 30 is indicated wherever a packing is needed for high pressure steam rods, expansion joints, air and gas services.

For centrifugal and rotary shafts working against steam, water, oil and weak acids Belmont 754 P can be considered a standard packing.

Belmont distributors are located in every large industrial center, or write on your company letterhead for a copy of the Belmont Packings Catalog and see the complete Belmont Line in detail.

THERE'S A BELMONT PACKING FOR EVERY SERVICE

Steam, Water, Oil, Gas, Air, Acids, Alkalies, Ammonia. Forms include: Rings, Spirals, Coils, Reels, Spools, Sheets, Gaskets.

THE BELMONT PACKING & RUBBER COMPANY

BUTLER & SEPVIVA STREETS • PHILADELPHIA 37, PA.

New Bulletins

(*Continued from page 172*)

MECHANICAL TRANSMISSION

43 V-BELTS and SHEAVES — Allis-Chalmers Mfg Co, Milwaukee 1, Wis. 44-page bulletin No. B6249 describes maker's line of fractional horsepower Texrope V-belts and sheaves. Booklet illustrated with installation photographs, line drawings and selection tables.

44 CHAIN DRIVES—Link-Belt Co, 307 N Michigan Ave, Chicago, Ill. 20-page booklet No. 1991 presents a series of tables which are said to give accurate results for shortening time required for calculating center distances and chain lengths of chain drives operating over cut-tooth wheels.

45 SPEED REDUCERS — Winfield H Smith, Inc, Springville, Erie County, N. Y. 24-page booklet, entitled "WHS is Part of This Picture," reveals the important part speed reducers have been playing in many phases of war production effort.

46 BELT AND CHAIN DRIVES—National Association of Fan Manufacturers, 5-208 General Motors Bldg, Detroit 2, Mich. Single page, Supplement No. A to Form X-12, contains a table on method of providing uniformity in designating motor position for belt or chain drives on fans and blowers.

47 CHAIN BELTS—Chain Belt Co, Milwaukee, Wis. 8-page bulletin No. 437 describes Rex Z-Metal chain belts for drive and conveyor service. Photographs show belt styles.

48 HYDRAULIC TORQUE CONVERTERS—Hydraulic div, Twin Disc Clutch Co, Rockford, Ill. 4-page booklet, entitled "20% More in '44," points out dangers of harmful propaganda in war effort. It also discusses a new twin-disc hydraulic torque converter. 16-page bulletin No. 135 gives purpose, operation, engineering, installation data and models of twin-disc hydraulic torque converter.

49 FLEXIBLE COUPLING — Farrel-Birmingham Co, Ansonia, Conn. 8-page bulletin No. 446 describes Farrel Manger couplings. Bulletin includes engineering details, application diagrams and tables of sizes, ratings and dimensions.

50 BALL BEARINGS—New Departure div, General Motors Corp, Bristol, Conn. 16-page booklet, entitled "Making Them 'Round'," explains how New Departure steel balls are made.

51 V-BELT DRIVES—Goodyear Tire & Rubber Co, 1144 E Market St, Akron, Ohio. 33-page pamphlet, entitled "Goodyear Engineering Data for V-Belts," contains details on care and installation of V-belt drives. One section is devoted to Goodyear's new steel cable V-belts.

52 WIRE GROMMET V-BELTS—B F Goodrich Co, Akron, Ohio. 4-page folder features company's line of V-belts, principally the wire grommet V-belt. Photographs help explain wire grommet V-belt construction.

METALS AND ALLOYS

53 METAL SURFACE TESTS—Meehanite Research Institute of America, Pershing Square Bldg, New Rochelle, N. Y. 8-page bulletin No. 17, entitled "A Study of Friction, Galling and Seizing," contains information developed as a result of recent researches into problems of galling, seizing and scuffing of metal surfaces in contact with one another. Booklet describes test methods and gives test results and conclusions.

54 METAL CASTINGS — Hamilton Foundry & Machine Co, Hamilton, Ohio. 36-page bulletin, entitled "Quality Castings by Hamilton," describes and illustrates the many gray iron and meehanite castings made by Hamilton. Booklet was erroneously listed under the heading "Pipe" in Mid-December issue.

CAST STEEL 1901

R

BRASS & IRON VALVES 1878

P&C CO

ENGINEERING SPECIALTIES 1870

JdE

YOU GET **better** VALVES THROUGH R. P. & C. SPECIALIZED PRODUCTION

"READING" Cast Steel Valves and Fittings are made by an organization that has devoted its whole life to developing pressure steel castings—castings finished into valves and fittings in accord with designs for high temperature service.

"PRATT & CADY" patents for brass and iron valves, now expired, show its participation in early developments of the valve industry—particularly the development of renewable features.

"D'ESTE" was an original manufacturer of reducing valves and pressure regulators—introducing the piston internal pilot control type.

★ ★ ★

Thus, READING-PRATT & CADY *offers you a single source for your valves. Whether they be of cast steel, brass or cast iron, or whether they be manually operated gates, globes, checks, et cetera, or automatically controlled regulators—they are made by an organization experienced, tooled and manned for the production of its particular type of valve, but each able to give you every advantage of the best thinking of the others. You get better valves through* R. P. & C. *specialized production.*

READING-PRATT & CADY

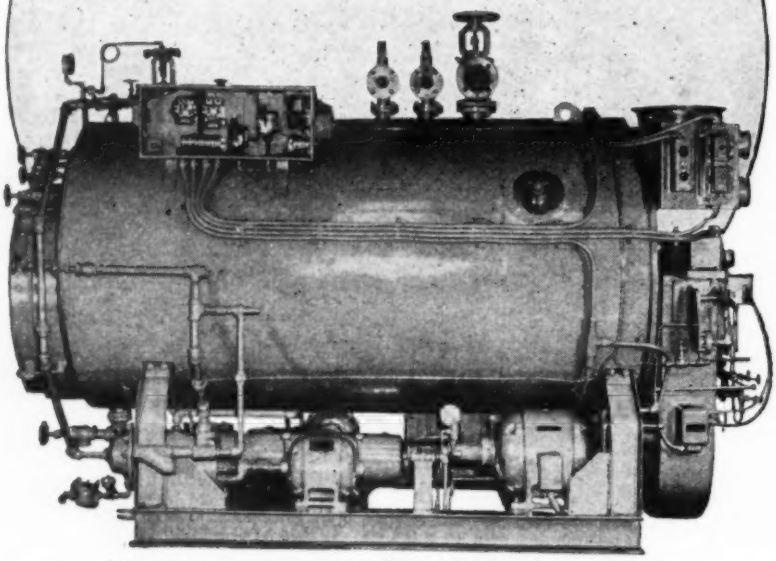
MANUFACTURERS OF
READING CAST STEEL VALVES AND FITTINGS • PRATT & CADY BRASS AND IRON VALVES
D'ESTE VALVE AND ENGINEERING SPECIALTIES

Reading, Pa., Atlanta, Boston, Chicago, Denver, Houston, Los Angeles, New York, Philadelphia, Pittsburgh, San Francisco

A DIVISION OF AMERICAN CHAIN & CABLE COMPANY, INC., BRIDGEPORT, CONNECTICUT

DOLLAR EFFICIENCY—

work done per dollar spent measures the value of steam generation



A Cyclotherm Generator that produces 4,000 lbs. of steam per hour

Hundreds of Cyclotherm Steam Generators in a wide range of horsepower have proved they can "take it" and deliver under all kinds of wartime conditions.

The Cyclotherm steam generator shown here, built for the United States Navy, is ruggedly constructed for heavy duty purposes. This unit is fired with Bunker C oil and produces 4000 pounds of steam per hour.

All Cyclotherms are fully automatic, completely self-contained and adaptable to processing, power or heat. The wide use of these generators has proved their unusual steam producing capacity per unit of fuel consumed. Cyclotherm's exclusive principles of combustion and design insure high efficiency at low operating costs.

Cyclotherms may be operated for years with a minimum of attention for they are designed and built to deliver efficient, trouble-free automatic service under exacting conditions.

They are manufactured in units from 10 to 300 horsepower, oil or gas fired. Deliveries are being made as rapidly as the press of Government orders permit. While the range of available units obviously cannot be on a peacetime basis, if you are planning immediate replacement, our engineers will be glad to cooperate in meeting your needs. We shall be happy to supply any additional information you may desire.

CYCLOTHERM
STEAM GENERATOR

AMES IRON WORKS
OSWEGO . . NEW YORK . . BOX 302

55 ALUMINUM — Aluminum Co of America, Pittsburgh 19, Pa. 28-page booklet, entitled "Aluminum Imagineering Notebook," presents twelve economic advantages of aluminum and illustrates equipment and materials designed from this metal.

METERS AND INSTRUMENTS, ELECTRIC

56 THERMOCOUPLES — Wheelco Instruments Co, Harrison & Peoria St, Chicago 7, Ill. 36-page bulletin No. S2-4 gives a description of products, prices and recommendations for thermocouple users and suggests substitutes for restricted materials.

57 WATTHOUR METERS — General Electric Co, Schenectady, N. Y. 24-page bulletin No. GEF-2721A contains information on renewal parts for V-type two-element polyphase watthour meters. Photographs of equipment are included.

METERS AND INSTRUMENTS, MECHANICAL

58 RECORDING INSTRUMENT—Leeds & Northrup Co, 4934 Stenton Ave, Philadelphia 44, Pa. 24-page catalog No. N-95-163, entitled "Micromax Condensate-Purity Instruments for the Steam Plant," describes how condensate is sampled continuously by a conductivity cell and its purity indicated and recorded automatically by a Micromax recording instrument. An L&N signalling conductivity controller is also listed.

59 PRESSURE GAGE—Manning, Maxwell & Moore, Inc, Bridgeport 2, Conn. 12-page bulletin on the phenolturret case Duragauge explains, in text and illustration, rotary movement, design and construction of system, dimensions, weights and available dials.

60 FLOWMETER — Simplex Valve & Meter Co, 68th and Upland St, Philadelphia 42, Pa. 20-page bulletin No. 300 gives operating principles, specifications and advantages of Simplex MO meters.

61 CHEMICAL THERMOMETERS — Faichney Instrument Corp, Watertown, N. Y. 56-page catalog No. 44 describes Faichney line of chemical thermometers. Temperature conversion table is included for changing temperature reading to either Fahrenheit or Centigrade.

62 SPEED INDICATOR—James G Biddle Co, 1211 Arch St, Philadelphia 7, Pa. One page bulletin No. 1750 discusses the Jaeger speed indicator, a vest-pocket speed-measuring device which adds up number of revolutions over a six-second period and shows revolutions per minute without any calculations.

PIPING, FITTINGS, VALVES AND SPECIALTIES

63 SOOT VALVE—Stock Engrg Co, W 98th St and Theodore Ave, Cleveland 2, Ohio. 4-page bulletin describes new valve for removal of soot and siftings from hoppers.

64 TUBE EXPANDERS—Airetool Mfg Co, Airetool and Yost Superior Factory Bldg, Springfield, Ohio. 26-page bulletin No. 21 covers application and operation of tube expenders in tube rolling and expansion processes.

65 SLIDE AND BUTTERFLY VALVES —Blast Gate Valve div, W S Rockwell Co, 50 Church St, New York 7, N. Y. 24-page catalog No. 406 features blast gate slide valves and butterfly valves for air, gas and liquid control.

66 HOSE CLAMP—Punch-Lok Co, 321 N Justine St, Chicago 7, Ill. 8-page catalog describes the Punch-Lok hose clamp, a mechanical device for connecting male and female fittings, special nipples, menders, or ordinary pipe to a hose.

Men
Methods
Materials
HISTORY OF A HIT TUNE
Tunesmiths capture a haunting melody, give it catchy words . . . A sweet voice sends it straight to the hearts of an audience . . . Sheet music echoes it through the nation—men, methods and materials combine to make a hit.

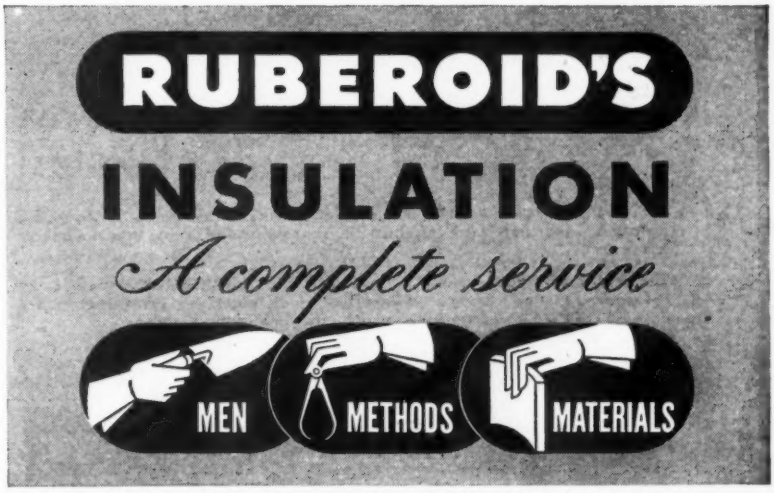
You get insulation efficiency the same way

● All the elements *properly coordinated*—men, methods and materials. This is the RUBEROID way to assure maximum service from industrial insulation.

MEN . . . The right men are all-important. Skilled mechanics in the nationwide organization of Ruberoid Approved Applicators handle the jobs. These men know their business. They've licked the most difficult insulation problems.

METHODS . . . Each installation is "tailor-made" to meet the individual job. Ruberoid engineers are not wedded to any one method. You get the benefit of broad experience with all possible methods of application.

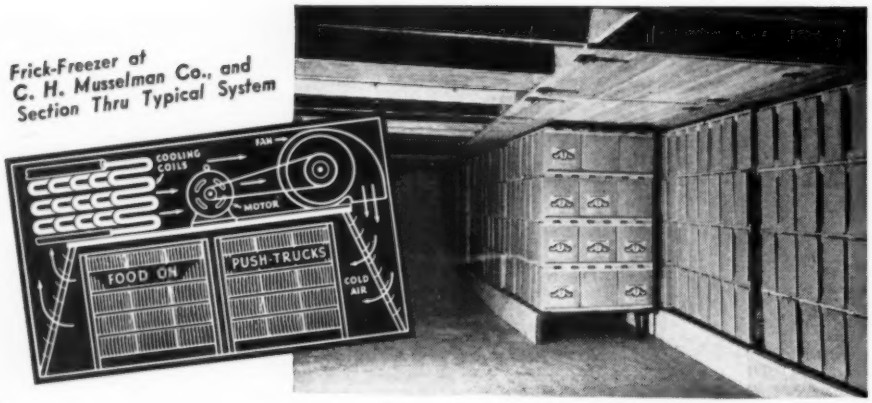
MATERIALS . . . The right insulation material to meet your specific temperature control problem. The Ruberoid insulation line has no "gaps" in it from 0° to 1900° F.



Write for Ruberoid Insulation Guide and technical data.

The RUBEROID Co., *Executive Offices*, 500 Fifth Avenue, New York 18, N.Y.

ASPHALT AND ASBESTOS BUILDING MATERIALS



Frick-Freezer at C. H. Musselman Co., and Section Thru Typical System

FROZEN FOOD PACKERS PREFER

This time for handling fresh apples, berries and other fruits. The C. H. Musselman Company, Biglerville, Pa., chose Frick-Freezing equipment after using Frick Refrigeration in this and other plants for nearly 10 years.

Frick-Freezers are setting the pace in revolutionizing the handling of foods! We believe more foods are already being frozen with Frick Equipment than by all other methods. Let us give you the whole story on Frick-Freezing. Write for Bulletin 147.

Frick Co., Waynesboro, Penna.

TRADE FRICK MARK

Refrigeration

A FREDERICK STOKER FEATURE
THAT IS GREATLY AIDING
THE FUEL CONSERVATION PROGRAM

Active Grate Area —no dead plates!

Reduced tonnage is the *rule* in plants where Frederick Stokers are installed, and important savings in transportation and labor thereby assured.

The increased grate area of the FREDERICK BURNING END results in a low combustion rate per square foot, and underfeed firing thoroughly burns every bit of coal—fully utilizes the heat-giving gases.

Other Frederick features are fully described in our new Stoker Bulletin. Write for your copy—there's no obligation.

THE Frederick IRON & STEEL CO.
Frederick, Maryland

PRIME MOVERS AND ACCESSORIES

67 AIR FILTERS — Air-Maze Corp, Cleveland, Ohio. 20-page general catalog No. AGC-144 discusses and illustrates panel filters for aircraft engines, ventilating systems and kitchen and galley range canopies; filters and filter silencers for both large and small engines and compressors; oil filters for fine particle separation; and a variety of special products, such as exhaust spark arresters, intake flame arresters and oil separators.

PUMPS

68 ROTARY PUMPS—Blackmer Pump Co, Grand Rapids 9, Mich. 6-page bulletin No. 304, entitled "Facts About Rotary Pumps," gives operation and advantages of Blackmer bucket design pumps.

69 PROPORTIONING PUMPS—Proportioneers, Inc, Providence 1, R. I. 16-page bulletin No. 1100 shows specific applications of Proportioneers' equipment in many fields. Diaphragm and plunger Adjust-O-Feeder pumps are described and details of their dimensions and capacities are included.

70 MECHANICAL SEAL—Durametallic Corp, Kalamazoo, Mich. 4-page bulletin features Dura Seal, a mechanical seal that rotates with shaft, for centrifugal or rotary pumps and agitators. Order sheet is included with booklet.

71 BOILER FEED PUMPS — Byron Jackson Co, Box 2017 Terminal Annex, Los Angeles, Calif. 14-page bulletin No. 42-4500 gives basic design principle and application of double-case boiler feed pumps.

72 CENTRIFUGAL PUMPS — Byron Jackson Co, Box 2017 Terminal Annex, Los Angeles, Calif. 8-page bulletin No. 42-7000 describes features and advantages of Hydropress pumps, which are vertical-shaft double-case multi-stage centrifugal pumps for low-capacity high-pressure service.

73 STEAM-JET VACUUM PUMPS—Schutte & Koerting Co, 12th and Thompson St, Philadelphia 22, Pa. 36-page bulletin No. 5-EH discusses single- and multi-stage jet vacuum pumps, in many sizes and models for low and high vacuum work.

WATER TREATMENT

74 WATER SOFTENERS—Elgin Softener Corp, Elgin, Ill. 16-page bulletin No. 603 describes zeolite water softeners and other water conditioning equipment. Bulletin also tells how to increase capacity and efficiency of existing zeolite softeners. Other subjects covered are iron removal, filtration, aeration and boiler water conditioning.

75 ph INDICATOR—E Leitz, Inc, 730 5th Ave, New York, N. Y. 24-page booklet provides a survey of electrode systems, description and directions for use of Leitz G & D Electro-Titrator.

76 DEGASIFICATION EQUIPMENT—Cochrane Corp, 17th and Allegany Ave, Philadelphia 32, Pa. 20-page bulletin No. 4076, entitled "Degasification of Water," points out available equipment for removal of gases from water at various temperatures.

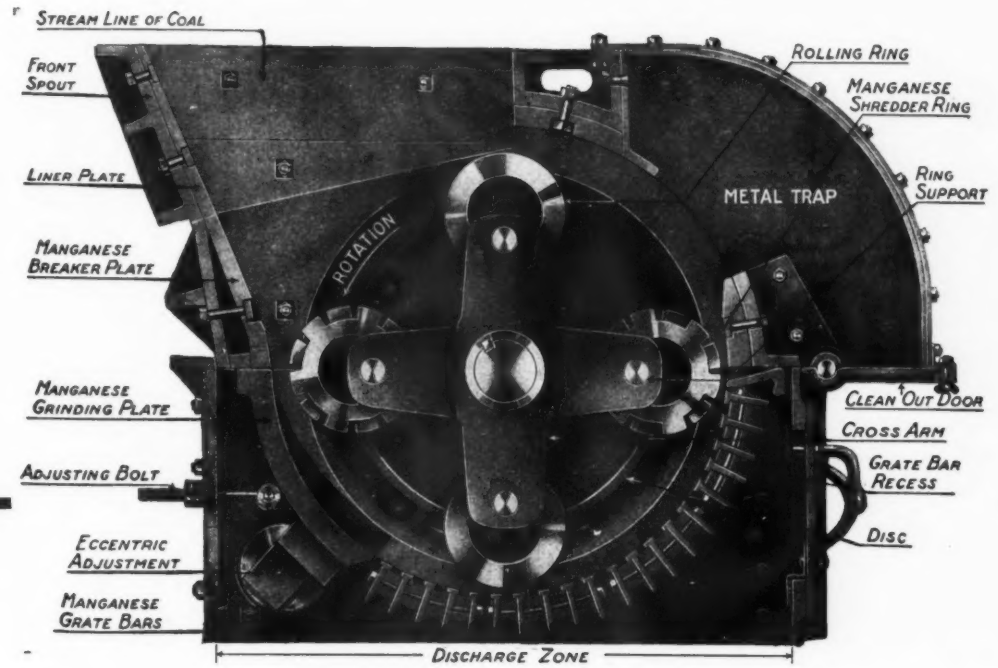
77 ION-EXCHANGERS — Worthington Pump & Machy Corp, Harrison, N. J. 6-page bulletin No. W-212-B4 describes Worthington ion-exchange process for water purification.

78 WATER SOFTENERS — Cochrane Corp, 17th and Allegany Ave, Philadelphia 32, Pa. 8-page reprint No. 30, entitled "Improvements in the Hot Process Water Softener," covers history of development of this method of feedwater conditioning. Chemical reagent and new improvements, both chemical and mechanical, are discussed. Illustrations show possibilities of silica removal, reduction of organic matter and typical installations.

WELDING

79 WELDING AND CUTTING EQUIPMENT—Victor Equipment Co, 844 Folsom St, San Francisco 7, Calif. 16-page bulletin, Form No. 20, discusses Victor line of welding and cutting equipment.

A "LOOK IN" on equipment that permits the use of difficult-to-grind coals . . . .



COAL IS GOING TO BE YOUR PROBLEM

Most of the problems which lie ahead for power engineers will center around coal—how to prepare coals having low grindability index—how to burn coals to produce steam at lowest overall cost—what equipment to use for preparing the kind of coal that will be available. Because coal holds the center of the stage and must be properly sized for economical use with stokers or for pulverized fuel firing, let's look into the "AMERICAN" way which has already been proved in service.

THE AMERICAN RING CRUSHER

Reference to the cross section of the AMERICAN RING CRUSHER shown here reveals its simpilicity of design. The "AMERICAN" is different from other centrifugal types in that its housing is a heavy cast steel casting, reinforced with ribs, a construction making it practically unbreakable. Then, too, anti-friction bearings, mounted dust-proof and oil-tight, reduce power requirements. Rotor shaft is of alloy steel, with spiders and cross arms keyed; rings are supported on shafts of high carbon steel and staggered to cover the entire grinding surface.

Crushing parts, including breaker plate, grinding plate, grate bars and rings are of manganese steel. Grinding plate is adjustable while crusher is in operation, making it possible to vary sizing to meet specific requirements.

Housing is lined with manganese steel liners, easily replaceable for wear. A metal trap or tramp iron catcher can be provided for protection against non-crushable material.

AMERICAN RING CRUSHERS are built in sizes to handle from 25 to 500 tons per hour. Write for bulletins covering complete details.

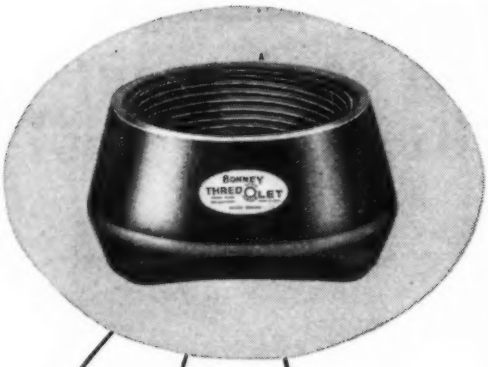
One of the Manganese Rolling Rings, in AMERICAN CRUSHERS, weighing about 27 lbs. Each of these ring applies centrifugal force at right angles to horizontal shaft. The ring strikes, rolls and crushes.

Patented manganese shredder rings in AMERICAN CRUSHERS split the coal and prevent clogging. Each ring has twenty cutting edges and maintains its outward position by centrifugal force. Because these rings are free to swing out of position, they are readily deflected when coming in contact with tramp iron. No safety devices are therefore necessary to assure protection.

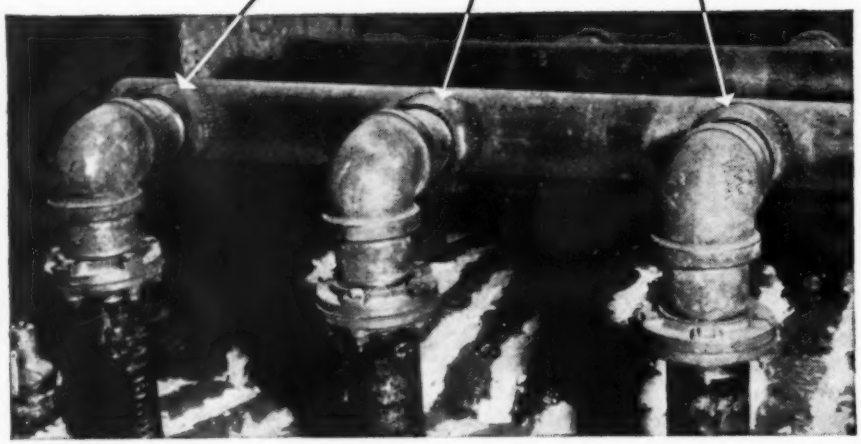
AMERICAN PULVERIZER COMPANY 1349 MACKLIND AVENUE ST. LOUIS, 10, MISSOURI

ORIGINATORS AND MANUFACTURERS OF RING CRUSHERS AND PULVERIZERS

WeldOlets are available in three types—with Welding Outlet, Threaded Outlet (illustrated at right) and Socket Outlet. Stock fittings are drop forged steel. Also available in Monel, Everdur, Toncan Iron, Wrought Iron, etc.



Here's the simple way to install branch pipe outlets



● On this piping installation the three branch pipe outlets were installed quickly and easily by the WeldOlet method. The elimination of any templates or the need for any cutting, forming or fitting, speeded and simplified the installation.

These drop forged fittings reinforce the junction so that the original strength of the main pipe is maintained. In addition, the extra large funnel-shaped opening, in the fittings where they join the pipe, cuts pressure loss and reduces turbulence and friction. The WeldOlet method is speedy and low in cost for both size to size or reducing branch pipe outlets. Size to size and reducing sizes are available from ¼" to 12". For complete information write for Branch Pipe Outlet Catalog WT31.

Forged Fittings Division

Bonney Forge & Tool Works • 342 Green St. • Allentown, Pa.

80 CURRENT - REGULATING COMPENSATOR—General Electric Co, Schenectady, N. Y. 4-page bulletin No. GEA-4207 covers application, description and operation of electronic current-regulating compensator for G-E thyratron welding control.

81 WELDING TOOLS AND ACCESSORIES—Dallett Co, Mascher at Lippincott St, Philadelphia, Pa. 8-page bulletin No. 500 describes pneumatic tools and accessories for industrial welding.

OTHER EQUIPMENT

82 HARD RUBBER—B F Goodrich Co, Akron, Ohio. 4-page catalog section No. 9405 lists distinctive qualities and applications of hard rubber, as well as products which can be manufactured from the material.

83 AIR EXPRESS—Air Express div., Railway Express Agency, 230 Park Ave, New York 17, N. Y. 16-page booklet, entitled "Vision Unlimited." contains some of the highlights of air express service, beginning with its inception in 1910.

84 BUSWAYS AND WIREWAYS — Square D Co, 6060 Rivard St, Detroit 11, Mich. 36-page bulletin gives complete description and application data, price information and illustrations of Saflex plug-in duct, Saflex feeder duct, Square-duct and screw cover duct for electrical distribution systems.

85 SUMP TANK CLEANER—Spencer Turbine Co, Hartford 6, Conn. 4-page bulletin No. 130, describes the Spencer Sump-Vac, a new portable vacuum producer which is said to clean machine sump tanks in 2 to 10 min. Also briefly described are applications of Spencer industrial vacuum cleaners and turbo-compressors.

86 BATTERY CHARGER — General Electric Co, Schenectady, N. Y. 4-page booklet No. GEA-3179B discusses construction, operation and dimensions of Phano-Charger No. CR7501-K, an adjustable, self-regulating electronic battery charger for maintaining storage batteries by floating method of charge.

CURRENT AWARDS

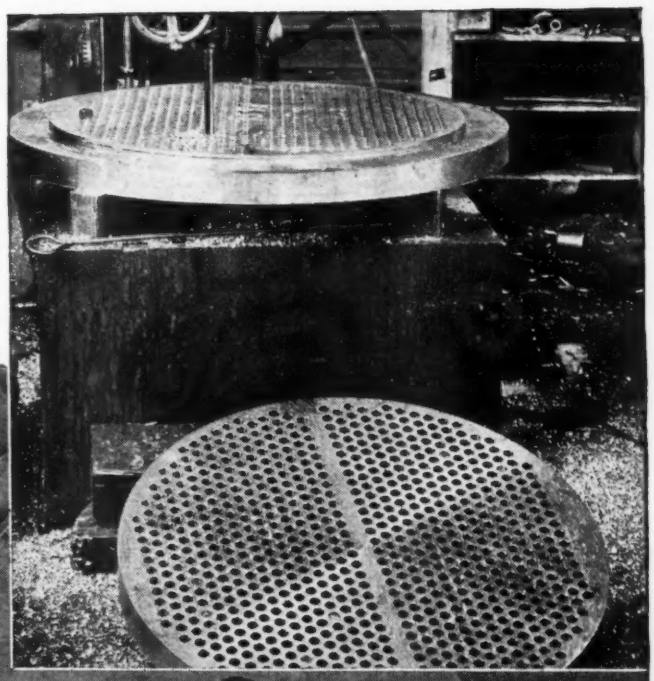
Army-Navy "E" pennants now fly over:
Link-Belt Co, Pacific div, Mar 30
U. S. Motors Corp, Apr 7
Cooper-Bessemer Corp, Apr 8
Anaconda Wire & Cable Co, Shelby and Muskegon plants, Apr 8.
John Nooter Boiler Works Co
The Buda Co, Apr 27

White stars (Army-Navy "E" renewals) to:
Askania Regulator Co, 1 star
Briggs Clarifier Co, 1 star
Warren Webster & Co, 2 stars
Solar Mfg Corp, West New York, N. J., 2 stars
Sterling Engine Co, 2 stars
Ohio Injector Co, 3 stars, Mar 16
The Electric Storage Battery Co, 4 stars
Cleveland Diesel Engine Div, General Motors Corp, 4 stars
Combustion Engrg Co, Army-Navy "E" to Savannah, Ga., assembly plant; Maritime "M" to Heine boiler div; 3rd star for "M" pennant to Hedges-Walsh-Weidner div.

ASME's semi-annual meeting will be in Pittsburgh, Pa., June 19-22. Because of its dominant position in steel and coal production, Pittsburgh is a natural place for mechanical engineers to discuss industry, production, transportation, management.

Canadian Assn of Stationary Engineers. A wartime meeting of the Grand Lodge of the assn was called in London, Ont., April 15, all subordinate lodges being represented. The governing executive body was reduced

Condenser Tube Plates by REVERE



Reaming Tube Sheet

Finished Revere Plates

JUST as Revere Condenser Tubes are preferred in thousands of power plants because of their long, satisfactory service, so are Revere Plates. The two make a perfect combination, both being made with the same high skill, to the same standards. Revere Plates are produced by hot-rolling "cakes" after machining the original casting to produce a perfect surface.

Revere's long experience makes it possible to deliver to you plates that are dense, free from blow holes and surface imperfections, characterized by flatness, accuracy of gauge, resistance to corrosion, and machinability.

Revere Condenser Tube Plates are available in squares, rectangles, circles, half-circles, segments, patterns, up to 120 inches. Plates may be obtained having a finished weight up to approximately 11,000 pounds. Muntz Metal is commonly used in steam condensers for generating plants. For special conditions of use Revere also makes plates and sheets of Naval Brass, Cupro-Nickel, Admiralty Metal, Copper, Herculoy, Manganese Bronze. For advice in selection of the proper alloys for condenser tubes and plates, write Revere.

Restrictions Lifted!

"Restrictions on the use of some copper base alloys that have limited the inclusion of these metals in the manufacture of tube and tube sheets of steam condensers, have been lifted, the War Production Board announced . . .

"This action will lengthen the average useful life of condenser tubes and sheets, according to WPB, and to a large extent eliminate costly shut-downs of installations using this type of equipment resulting from failure of parts made with substitutes . . .

"The use of copper will also reduce the quantities of replacement and maintenance parts made necessary by the unsatisfactory performance of alternate materials."

—News Release from Office of War Information

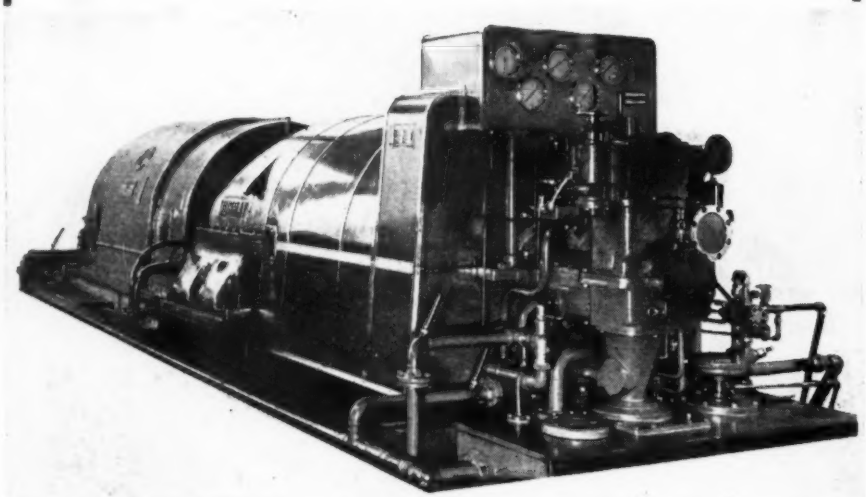
REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

Executive Offices: 230 Park Avenue, New York 17, N. Y.

One of Four
MURRAY
2500 KW CONDENSING
TURBO GENERATOR UNITS



Installed in the same plant

Turbine—600#—750°—29" vac. Generator—2500 kw at .80 P. F., 3 phase, 60 cycles, 13800 volts

MURRAY TURBO GENERATOR UNITS are available over a wide range of sizes and types

• The organization has occupied a prominent place in the steam power equipment field for three-quarters of a century. MURRAY equipment including Boilers, Turbine Generators, Mechanical Drive Turbines. Both horizontal and vertical gears and engines serving throughout the world reflect the skill used in building each unit.

Let us help you solve your steam power problems.

MURRAY
IRON WORKS COMPANY
INCORPORATED 1870
BURLINGTON IOWA

for the duration from a 7-man to a 3-man board composed of Serraphine Stemmler, pres; James McNary, treas; G H Caldwell, secy. Highlight of the meeting was the attendance of R Gofton, an operating engineer for over 55 yr and a charter member.

Proceedings of the 4th Annual Water Conference of the **Engineers Society of Western Pa.** are available at $3.15 a copy. Address the Society at Wm Penn Hotel, Pittsburgh, Pa. The 5th Annual Water Conference will be held Oct 30 to 31 at Wm Penn Hotel.

Nat'l Electronics Conference, Oct 5 to 7, in Chicago, will fulfill the need for a discussion forum on applications in the broad field of electronics. Emphasis will be on engrg aspects. The conference is sponsored by Ill. Institute of Technology; Northwestern Univ; Chicago section, Institute of Radio Engineers; Chicago section, Am. Institute of Electrical Engineers.

Estimated to be the oldest and largest industrial advertising agency west of Chicago, **The McCarty Co,** Los Angeles, will celebrate its 25th anniversary. It still serves many of its original clients.

Under the contract approved by FPC, The Montana Power Co will pay the U. S. for: (a) electric energy generated by the Ft Peck project on the Missouri River, Montana, 2.5 mills per kwhr and (b) $30,000 per yr for use of Government facilities for assuring continuity of service and regulation at two of the delivery points; provided that this annual charge will be remitted to the extent that the charges for energy exceed $220,000 per year. The order states that to make available to the company power needed in the war effort, the Bureau of Reclamation has been supplying The Montana Power Co with **electric energy** from the Ft Peck project since July 1, 1943, on the terms of the proposed contract.

Curved Sluice Gate

This 4x6-ft sluice gate, one of several built by Rodney Hunt Machine Co for installation in Mexico, has a curved gate to cut down flow losses through it. Amount of curvature was determined by test, which showed that this simple modification of conventional sluice-gate design improved water-control efficiency.

PRODUCT OF THE MONTH

Texrope Super-7 V-Belts result from the cooperative research and design of two great companies—Allis-Chalmers and B. F. Goodrich—and are sold exclusively by A-C.

MILWAUKEE, WIS. — Allis-Chalmers announces the Texrope Super-7-Steel . . . a new V-belt employing endless steel cables to provide greater horsepower transmission, reduce belt stretch. For proper applications of Super-7-Steel, check with nearby Allis-Chalmers district office or Texrope dealer.

A 1711

WE WORK FOR VICTORY — WE PLAN FOR PEACE

ALLIS-CHALMERS MILWAUKEE · WISCONSIN

Tune in the Boston Symphony, Blue Network, Saturday at 8:30 pm, EWT.

When shipments are ready—

LET 'EM GO!

WHEN AIR EXPRESS shipments are allowed to lie around waiting for end-of-the-day pick-up, you're throwing away a chance for earlier delivery. *Ship when ready!* Call AIR EXPRESS the instant the label is on. This saves your shipment from running the gauntlet of end-of-day congestion at the airport, assures earliest possible delivery at destination. Remember: when they're ready—*let 'em go!*

A Money-Saving, High-Speed Wartime Tool For Every Business

As a result of increased efficiency developed to meet wartime demands, rates have been reduced. Shippers nationwide are now saving an average of more than 10% on Air Express charges. And Air Express schedules are based on "hours", not days and weeks—with 3-mile-a-minute service direct to hundreds of U.S. cities and scores of foreign countries.

WRITE TODAY for "Vision Unlimited"—an informative booklet that will stimulate the thinking of every executive. Dept. PR-6, Railway Express Agency, 230 Park Avenue, New York 17, N. Y., or ask for it at any local office.

AIR EXPRESS
AIR EXPRESS
Gets there FIRST

Phone RAILWAY EXPRESS AGENCY, AIR EXPRESS DIVISION
Representing the AIRLINES of the United States

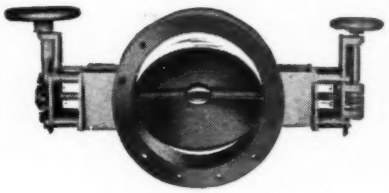
New Equipment

(*Continued from page* 126)

vides ventilation. Accurately machined front head provides for permanent alignment. Armature is coupled to engine by a special high torque coupling, driving half of which is provided with a ball bearing that takes the weight of forward rotor end. Switchboard is heavy-duty equipment, with dead-front cabinet equipped with a circuit breaker, field rheostat, voltmeter and ammeter. *Bardco Mfg & Sales Co, Los Angeles, Calif.*

Carbide-Tipped Tools

MALTA JC SERIES carbide-tipped tools, a line of cemented carbides for cutting steel, cast iron, non-ferrous and non-metallic materials, are made in ten styles in wide size range and three tip grades: MF for miscellaneous finishing, SF for steel finishing, and CR for coarse roughing. Grades are distinguished by colored shank ends for proper selection. *Jessop Steel Co, Washington, Pa.*

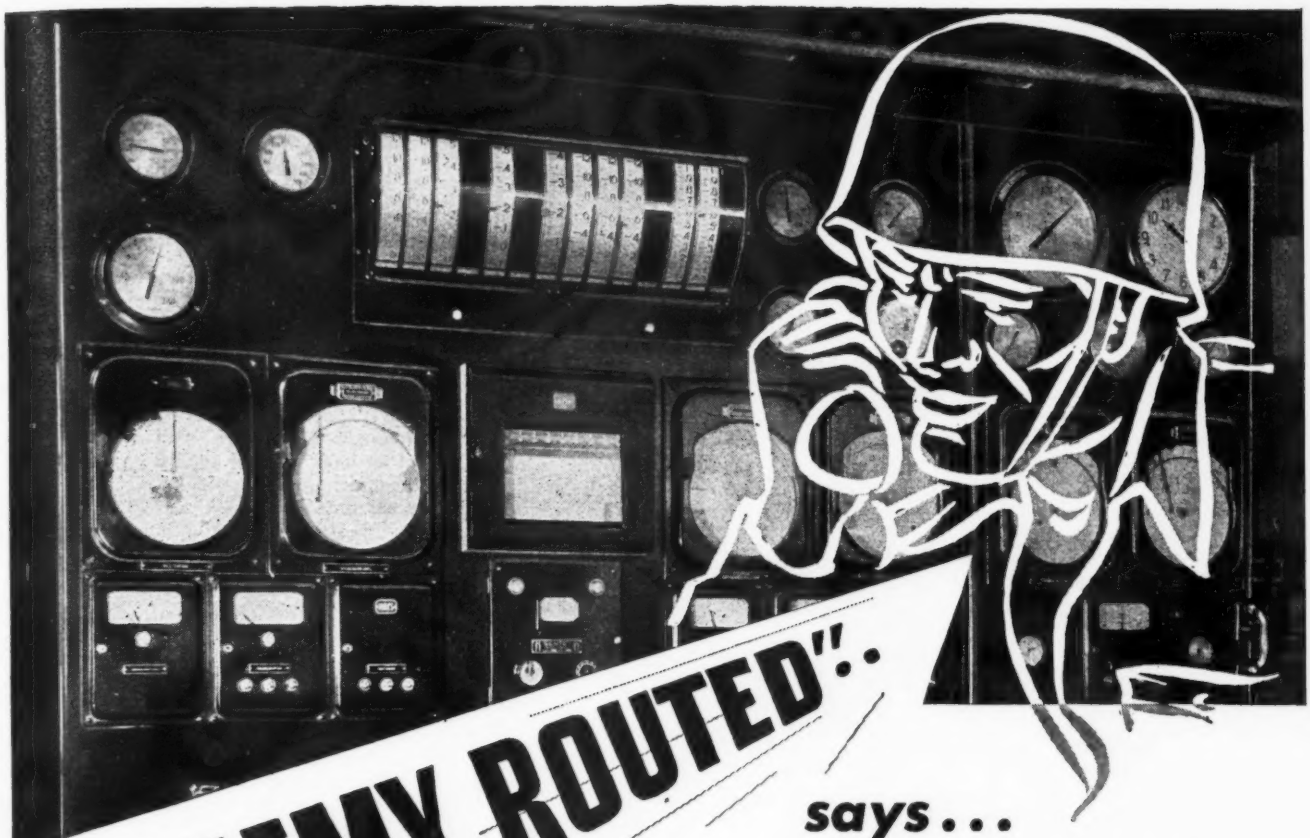


Two-In-One Valve

FOR EITHER A HIGH-PRESSURE DROP and small volume or a low-pressure drop and large volume, dual-purpose No. 608 butterfly valve operates beyond limitations of a single valve. Close control and shutoff of volume and pressure may be obtained. Valve adapts easily to power operation. Larger beveled vane seats against valve body, while smaller vane revolves freely. Four to six handwheel revolutions completely open or close either valve vane. Available in various size combinations and for operating pressures of 15 to 900 psi. *R-S Products Corp, Wayne Junction, Philadelphia 44, Pa.*

Glass Ring Jewels

INTRODUCED RECENTLY as a substitute for foreign-made sapphire bearings, glass ring jewels are an outgrowth of developing glass V-jewels. Ring jewels are said to be superior to sapphire in many respects and at approximately one third the cost. They may be press-set or spun-set into bearing plates and other elements in same manner as sapphire rings. Hole surface in glass ring is fire polished in manufacture and is not touched subsequently. Flat surface opposite *bell end* of hole is highly polished by brushing with an abrasive. This surface is slightly chamfered at hole edge and at jewel outside edge. Outside diameter of opposite flat surface of jewel is also slightly chamfered to facilitate press setting and to avoid a



"ENEMY ROUTED"..

says...

BOILER ROOM COMMUNIQUE!

VICTORY news is heartening these days — and none is more vital than reports from steam-power plants where Hays Automatic Combustion Control is giving fuel waste and high steam cost a thorough beating.

Many a power plant has been promoted, under the pressure of war industry's effort, to an efficient economical, *safe* plant — through the installation of Hays equipment.

Hay's Combustion Control — "the All-Electric Way" — regulates every combustion factor, to maintain even steam pressure under fluctuating demand. It measures each variable; records its measurements on a central panel; corrects each variation instantly; in short, provides exact, *balanced control — automatically.*

The Hays Combustion Control Catalog is full of helpful steam-power data. Write for a copy today.

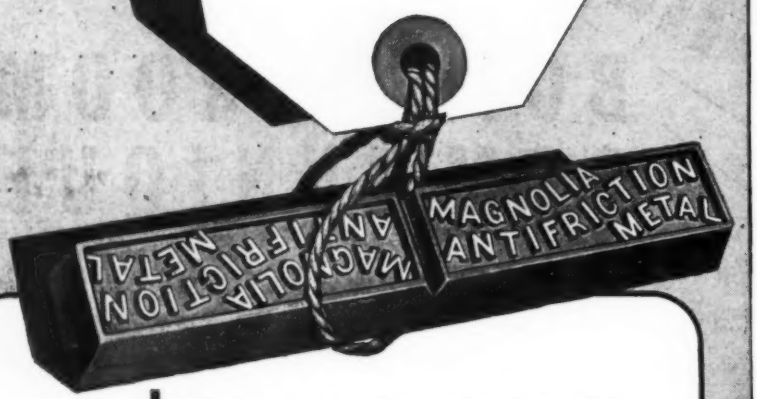
THE MODERN SYSTEM *It's Electrical*

HAYS *Automatic* COMBUSTION CONTROL

THE HAYS CORPORATION • MICHIGAN CITY, IND.

Still available!

MAGNOLIA ANTI-FRICTION BEARING METAL



In the last two years many bearing metals have disappeared from the market. But MAGNOLIA ANTI-FRICTION METAL is still available.

And, furthermore, its composition remains unchanged. It is still the same graphite-treated, self-lubricating alloy having the lowest coefficient of friction of any known bearing metal — 300% lower than genuine babbitt.

The next time bearings need relining, why not use this well known, widely accepted metal? Your local distributor carries MAGNOLIA ANTI-FRICTION METAL in stock for immediate delivery.

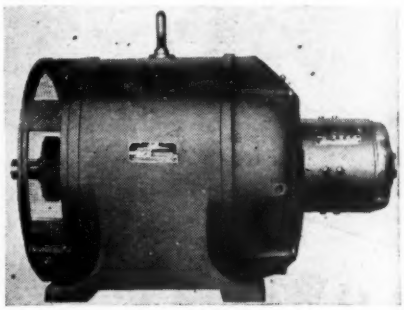
MAGNOLIA METAL CO. • ELIZABETH 4, N. J.

MAGNOLIA BEARING METALS

fragile edge. Dimensions are held to extremely fine tolerances, according to manufacturer; concentricity of inside and outside diameters of bearings is said to be unusually accurate. Five sizes of bearings listed include 0.100, 0.0787 and 0.064 in. outside diameters. Rings have been made experimentally in sizes up to 0.5 in. outside diameter and holes have been molded down to 0.005 in. diameter. *General Electric Co, Schenectady, N. Y.*

Penetrating Oil

KANO KROIL LOOSENS FROZEN METAL parts quickly without harm to metal. Manufacturer claims that tests show that Kroil creeps into spaces as small as a millionth of an inch. Kroil is applied on nuts, bolts, studs, screws, pulleys, shafts, bearings, guns, pipe threads, spindles, valve guides or on any corroded threads or tight parts. *Kano Laboratories, 75 E Wacker Dr, Chicago.*



Ac Generators

UNIT HAS A revolving field generator arranged to bolt direct to engine housing and a generator shaft machined to receive a flange that bolts direct to engine shaft. Generator has one bearing, with engine end of shaft supported by engine bearing. Exciter is mounted on end of generator opposite engine. Exciter shaft is inserted in and keyed to generator shaft on inner end and generator bearing carries the exciter, which has one bearing at outer end. Generator, exciter and engine form a compact unit. Century ac generators in sizes ½ to 150 kva, for direct connection or belted drives. *Century Electric Co, 1806 Pine St, St. Louis.*

Adjustable Speed-Drive Control

LINE OF ADJUSTABLE SPEED, electronic motor drives provide dc motor performance from ac power without special motors. Unit for any machine driven by a dc shunt motor. Electronic rectifier tubes convert ac to dc, supplying separate power to dc motor armature and field circuits. Electronic tubes individually control each circuit to provide speed adjustment and current regulation. Method for controlling armature current prevents excessive current ripples. Full field strength of motor and limited armature current is utilized in starting so that maximum torque may be had without causing excessive power-line surges and consequent interference with other equipment drawing power from same distribution system. Obtain complete stepless control of motor speed from a few rpm to double basic motor speed by setting a dial. Dial ad-

Scovill Tube News

Vol. 2 SCOVILL MANUFACTURING COMPANY, Waterbury 91, Conn No. 4

Corrosion of Condenser Tubes ...Causes and Cures

Scovill offers two folders on obtaining longer tube life

Among the common causes of corrosion in condenser and heat exchanger tube metal are the following, each of which is discussed in two folders which have been prepared by Scovill Manufacturing Company engineers as one of three Scovill services to power plant operators:

Film Formation

The ability of copper and its alloys to form protective films on their surfaces explains their inherently excellent corrosion resistant properties. In order to be protective, the film must be adherent, continuous and relatively insoluble. The formation of soluble salts at the metal surface will lead to continued corrosion. Likewise, coatings which are porous, loosely adherent, friable or easily broken, or discontinuous, offer little protection to the metal.

Accelerated Uniform Corrosion

Tubes in service under conditions which result in corrosion at the tube surface with the formation of soluble salts only, will undergo a uniform thinning of the tube wall. This is often experienced in acid solutions, particularly with oxidizing acids or acid solutions containing oxygen or an oxidizing agent. Solutions which have a definite solvent action on the products of corrosion of copper alloys, such as solutions containing ammonium hydroxide or cyanides, would behave similarly.

Impingement Attack, End Corrosion, etc.

Rapid and repeated destruction of protective surface films usually occurs at or near the inlet end of the tubes and is variously described as "impingement attack, end corrosion, etc." There are usually certain localized areas in a unit or sections of a unit where failures from this cause predominate. The destruction of protective films at such localized areas is due to a relatively high velocity of the circulating medium, together with a turbulent condition and the action of entrained or separated air.

Concentration Cell Action

Many cases of localized corrosion and failure of condenser and heat exchanger tubes are due to local differences in solution, concentration or composition which may develop at the metal surface. A break in an otherwise satisfactory protective film may initiate such action. Cracks, crevices or other small openings at baffle or support plates where liquids may seep and become trapped are always a potential source of trouble in this respect.

Deposit Attack

Corrosion of the "deposit attack" type (a special form of "concentration cell" action) is directly due to the settling out or lodgment on the tube wall of sand, mud, coke, stones, wood, shells, flakes of iron scale, etc. Part of the metal surface becomes shielded or protected by the deposit and usually becomes anodic to adjacent metal areas; intense pitting at such shielded areas is likely to occur. If the deposit is of sufficient size to interfere seriously with the flow of the circulating medium, turbulence, air separation and erosion-corrosion of the down-stream side of the tube may take place.

Plug- and Layer-Type Dezincification

Brasses containing less than 85% of copper may undergo corrosion which results finally in the gradual replacement of the brass by a spongy, porous copper deposit. This deposit may occur locally, developing into "plugs" of copper, or it may occur uniformly over the tube surface — in which case it is designated as "layer-type" dezincification. Conditions which favor dezincification of condenser tubes are:

(1) Contact with waters slightly acid in character and of a low degree of aeration.
(2) Relatively low velocity of water over the tube surfaces, or stagnant water in tubes.
(3) Relatively high temperatures.
(4) Certain types of permeable scales on the metal surface.

Galvanic Action

The indiscriminate use of dissimilar metals and alloys in any service, when they make good contact and are also subjected to a conducting medium, may lead to the early failure of one member of the couple. In the design of equipment which is to be used for handling liquids, moist gases or vapors, therefore, the possibility of galvanic corrosion should be given careful thought.

Such are the common causes of trouble. The cures for these troubles may be determined with the aid of Scovill's two other services:

Service in Men, which gives you the benefit, through consultation, of the many years' experience represented by Scovill engineers.

Service in Metals, which gives you complete laboratory and production facilities (as national needs permit) in the working-out of a solution to your problem.

For a further demonstration of *Service in Manuals*, of which the foregoing information is a sample, write us for Scovill's free "Condenser Tube Booklet", containing diagrams, formulae, description of alloys. Address Scovill Manufacturing Company, 13 Mill St., Waterbury, Conn.

THIS IS NUMBER TEN in a Series of Scovill Advertisements to help you get longer life from condenser and heat exchanger tubes.

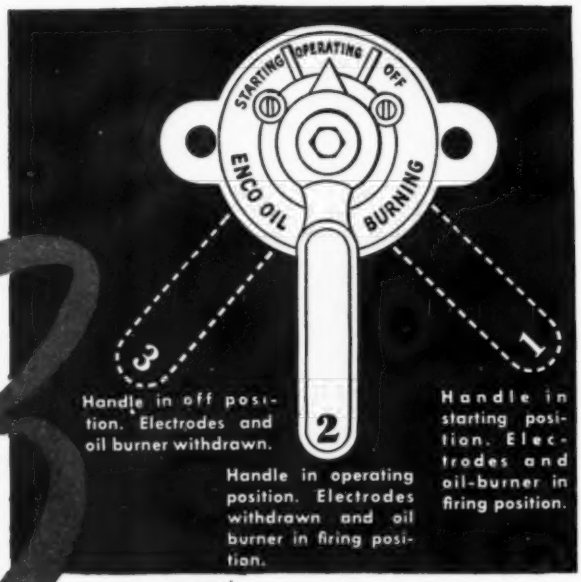
Scovill
MANUFACTURING COMPANY
WATERBURY, CONN

SCOVILL CONDENSER TUBES

ONE PRODUCT... THREE SERVICES

Service in Manuals... Service in Metals... Service in Men

Hand Control Valve for cylinders . . . wall mounting . . . oil burner ignition system.



3 Step IGNITION SYSTEM FOR PULVERIZED COAL, OIL, OR GAS

FAST
SAFE
POSITIVE

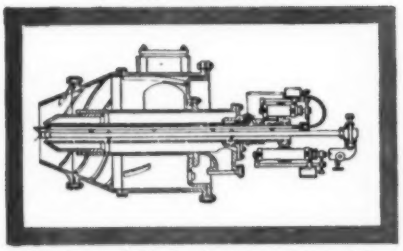
With an Enco Ignition System, operator can light off any burner by movement of a Hand Control Valve, located close to the pulverized-coal mill and fan controls, and within view of the instrument board. Automatically, a powerful ignition spark is established, and the light fuel turned on. Both are interlocked electrically — **the oil valve cannot be opened until the spark current is on and the atomizer is in firing position.** After the oil flame is established, a second movement of the control valve retracts the electrodes, leaving the atomizer in operation.

After ignition of the pulverized coal is established, a third movement of the control valve shuts off the oil and retracts the atomizer out of the hot zone, leaving the unit ready to repeat the operation as may be needed.

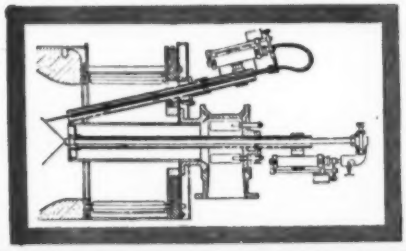
The Enco Ignition System has a wide range of application. Pulverized coal, blast furnace gas or any liquid fuel may be ignited by the unit, or the spark alone may be used to ignite natural or refinery gas. The ignition flame can be changed gradually from light to heavy fuel oil if continued operation under heavy load is required. The ignition flame also can be used as a substitute for principal fuel in emergencies.

Bulletin on request.

Atomizer and electrodes in the central tube.



Atomizer and electrodes in separate tubes.



THE ENGINEER COMPANY
75 West Street, New York 6, N. Y.

Canada: F. J. RASKIN, Inc.
370 Rachel E., Montreal, P. Q.

Enco OIL BURNING EQUIPMENT

justment may be made while motor operates or it may be preset before starting. In addition to start, stop and speed-selection controls of standard units, reverse, with or without an independent reverse speed selection control, can be supplied. Dynamic braking, dual-control stations, limit switches, or sequence and time controls, may be used with units, for complete machine or process cycle control. All transformers are built into steel cabinet to make one self-contained unit. Units may be wall or floor mounted at any convenient location. Capacities are from ½ to 3 hp single phase and 5 to 10 hp three phase. Other sizes or special designs may be ordered. Standard voltages are 220/440 at 60 cycles, 550 v and 25- or 50-cycle machines may be supplied. *Weltronic Co*, 20735 *Grand River, Detroit* 19, *Mich.*

Brush Cleaner

PRESTORER CLEANS or softens brushes, regardless of size or shape. It requires no boiling of water, no dissolving of powders, no scraping or combing; simply immerse bristles in solution. New brushes cleaned in a few hours, old brushes in 12 to 96 hours. Prestorer is claimed not to injure hands for it contains no high-powered caustic alkalies. It is non-inflammable and may be used safely in poorly ventilated rooms as it gives off no poisonous fumes. Solution may be strained through cheese cloth for reuse. *Technical Development Laboratory, Tenafly, N. J.*

Fluorescent Lighting Unit

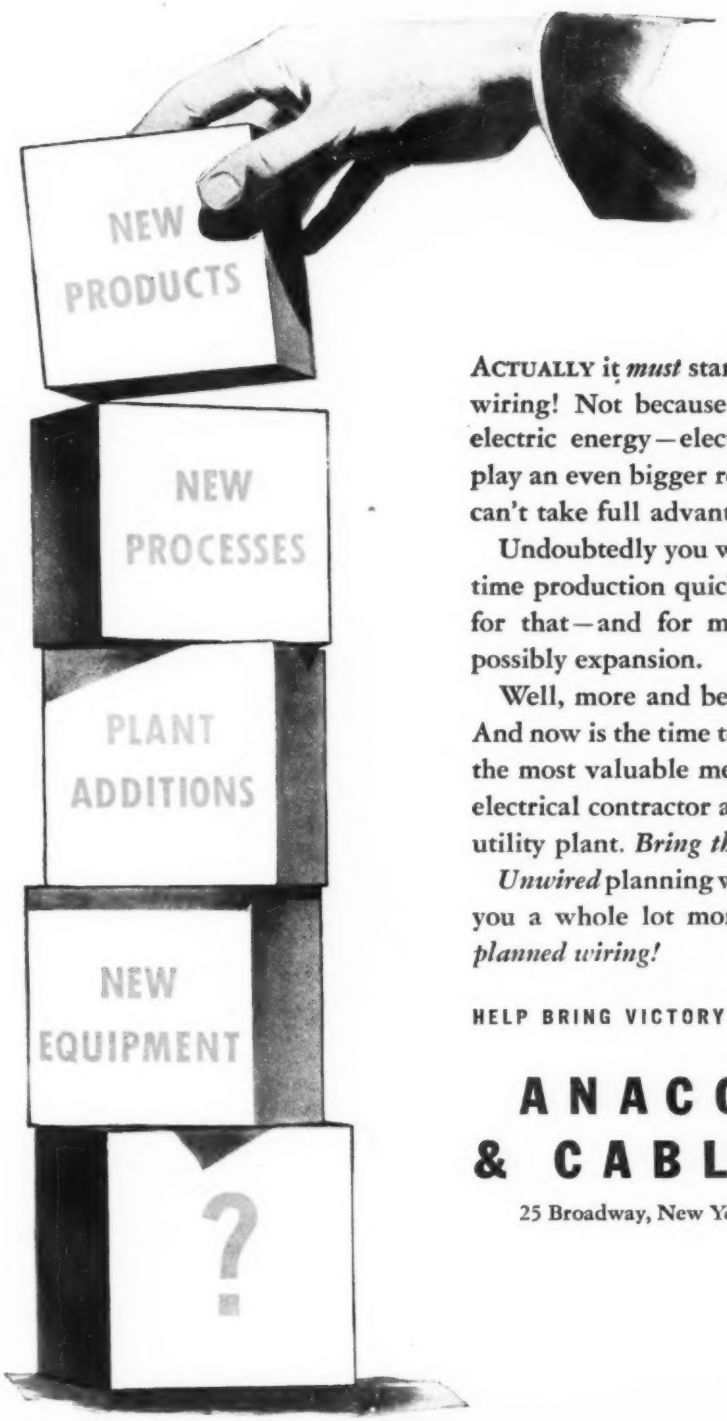
MITCHELL KOLD-VOLT Model 2081 fluorescent lighting unit operates from 110 to 125 v, 60-cycle ac, pf 99%. It has four Colovolt cold-cathode low-voltage fluorescent tubes and may be surface or suspension mounted, individually or in continuous rows. Unit is said to offer the following advantages: (1) Starters eliminated. (2) Starting instantaneous. (3) Lamp life four times that of conventional *F* fluorescent lamp. Each lamp in unit unconditionally guaranteed for one year without replacement. (4) Operation at lower room temperatures. Low temperature does not affect starting. (5) Not sensitive to line-voltage variation. (6) Reduction of maintenance time and cost. (7) Fewer fixtures to install because of 8-ft length. (8) Surface glare substantially reduced. *Mitchell Mfg Co*, 2525 *N Clybourn Ave, Chicago* 14, *Ill.*

Tipped Tools

STYLES P AND Q TOOLS consist of a cutting tip of Stellite 98M2 cobalt-base alloy brazed or butt-welded to a tough steel shank, with proper clearance and lead angles ground for turning steel. These and other Stellite-tipped tools are for applications requiring a large cross section, or that are bent or offset, or for holders which make solid tool bits impractical. In addition to turning, boring and facing, they are also for various forming and grooving operations. Style P is a right-hand tool; Style Q, a left-hand. They are ground with a 15-deg end cutting-edge angle, 15-deg side cutting edge angle, 7-deg end relief angle and 7

(Here's another ad in the series that brings a vital message to your customers.)

Know where that postwar plan of yours ought to START?



ACTUALLY it *must* start with electrical wiring . . . *adequate* wiring! Not because we think so—but simply because electric energy—electric-motorized power—is going to play an even bigger role in postwar production. And you can't take full advantage of it without the right wiring.

Undoubtedly you want to swing your plant into peacetime production quickly after the war. You've got plans for that—and for modernization . . . improvements . . . possibly expansion.

Well, more and better wiring will have to come first. And now is the time to plan for it—in advance. Just about the most valuable men you could talk to today are your electrical contractor and a power engineer from the local utility plant. *Bring them into the advance planning stage.*

Unwired planning will cost you a whole lot more than *planned wiring!* 44226

ADEQUATE WIRING — KEY TO POSTWAR BUSINESS — SERVES AND SAVES

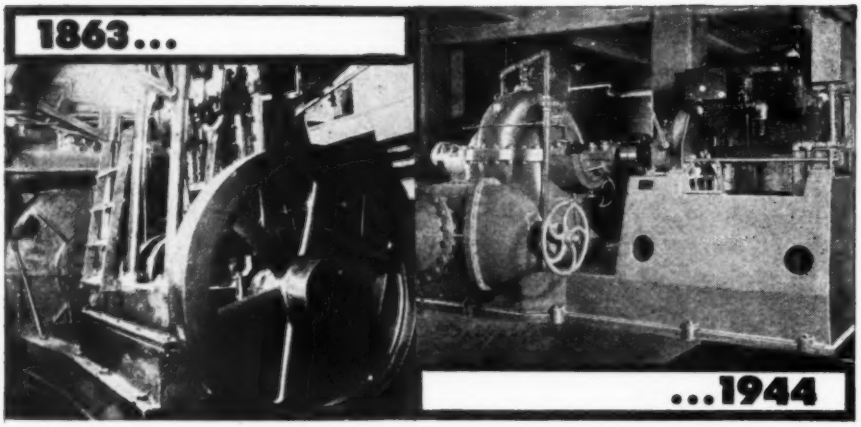
HELP BRING VICTORY SOONER . . . BUY MORE WAR BONDS.

ANACONDA WIRE & CABLE COMPANY

25 Broadway, New York 4 . . . Sales Offices in Principal Cities

ANACONDA

Electrical Wires and Cables of Copper are the Life Lines of our Nation



EXPERIENCE – important ingredient of good packings

THIS IS THE **7th** of a series explaining why G-T PACKINGS give better service.

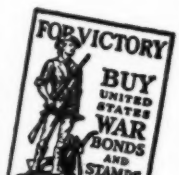
8 REASONS for the Superiority of G-T Packings

1. SIMPLE LINE . . . makes correct selection easy
2. COMPLETE LINE . . . an exactly suitable type for every service.
3. SELF LUBRICATING . . . each individual strand saturated with lubricant
4. SPECIAL LUBRICANTS . . . lubricant for each service specially compounded in our own plant
5. SELECTED YARNS . . . provide tensile strength and resist high temperature
6. CONSTRUCTION . . . assures maximum endurance, longest life, lowest friction
7. EXPERIENCE . . . 80 years of manufacturing experience
8. PERFORMANCE . . . proven in thousands of plants of every type

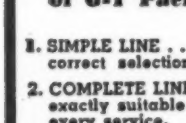
You cannot see or feel the experience that goes into the manufacture of the packing you buy, but this factor is an essential element in its life, service, and ultimate cost.

An experience of more than 80 years is part and parcel of every G-T Packing. This experience means "know-how" in making packings . . . it means that you get precisely the right yarns and lubricant for your particular service, fabricated into a perfectly made packing which effects the tightest seal, over the longest period, with the least amount of frictional wear of the equipment.

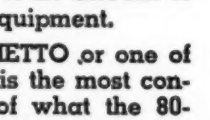
An actual trial of PALMETTO or one of the other G-T Packings is the most convincing demonstration of what the 80-year G-T knowledge can mean to you. Hundreds of Engineers have made such a trial, with the result that most of them have standardized on these low-friction, long-life packings. Select the correct grade of G-T Packing from the list below and make your own test . . . under your own conditions. Your distributor can supply you.



GREENE, TWEED & CO.
Bronx Blvd. at 238 St., New York 66, N.Y.
PLANTS: New York, N. Y. and North Wales, Pa.



PALMETTO for steam, hot water, air. PALCO for water. PELRO for oils. CUTNO for alkalis. SUPERCUTNO for acids. KLERO for foods, etc. PALMETTO SUPERSHEAT PACKINGS



G-T *self-lubricating* **PACKINGS**

deg side relief angle. Tools have flat tops so that users can grind their own side rake angle for each particular job. Sizes of each tool are: ⅝x1¼x8, ¾x1½x9, 1x1x7, 1x1¼x7 and 1¼x1¼x7 in. Styles P and Q are also made with Stellite Star J-Metal tips. *Haynes Stellite Co, Kokomo, Ind.*

Constant-Level Lubricator

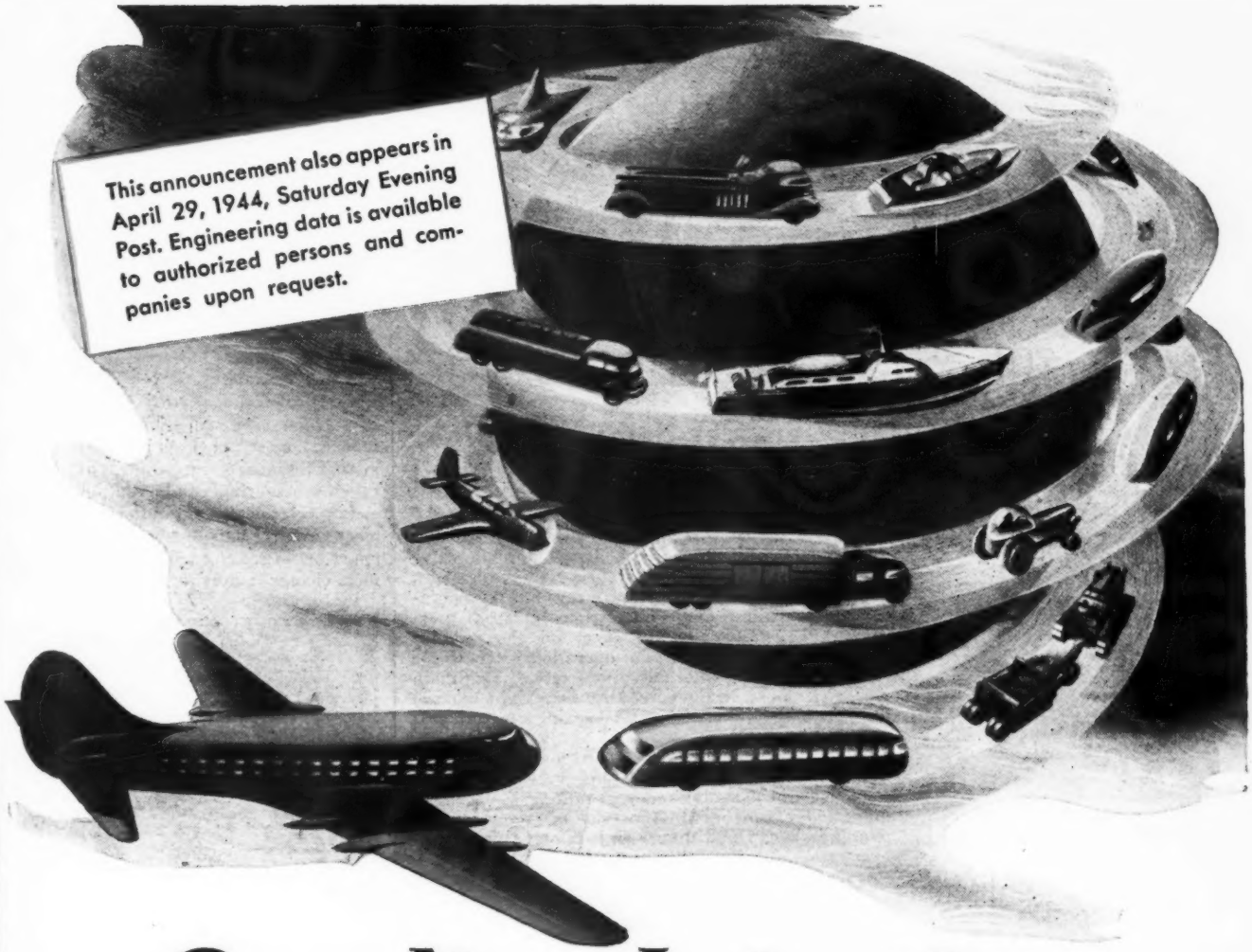
J CONSTANT-LEVEL LUBRICATOR is for electric motors, pillow blocks, pumps, air-conditioning equipment, gear boxes, etc, wherever bearings and other machinery parts must be provided with an ample lubrication supply. Lubricator construction consists of the base, dome and reservoir. Operating principle provides large and separate passages for air and oil, hence lubricant flow is not restricted. J Oil-Rite constant-level lubricators come in four standard sizes with 2, 4, 8 and 16-oz capacities. *Oil-Rite Corp, 3478 S 13th St, Milwaukee 7, Wis.*

Flexible Metal Hose Fittings

SEAMLEX DT DETACHABLE FITTINGS, ¾-in. ID, consist of only three parts. Fittings are claimed to provide triple safety against leakage because of the metal-to-metal seat, concentric guide and automatic stop. They are especially recommended at temperatures above 250 F. *Seamlex Co, 27-27 Jackson Ave, Long Island City, N. Y.*

Contact Printers

IT IS NOT NECESSARY to have a photo dark room with No. 1518 AP and No. 1518 BP contact printers for making negative and positive photo copies, 15x18 in. or smaller. They make copies from black and white, colored, printed on one or two sides, single sheets or books. Plate-glass copy area, firm pressure top and separate negative and positive light circuits of No. 1518 BP printer are claimed to speed operation and produce clear, sharp prints. Translucent glass diffusing medium insures proper light


This announcement also appears in April 29, 1944, Saturday Evening Post. Engineering data is available to authorized persons and companies upon request.

Gasoline Injection

MORE POWER FOR THE WORLD OF TODAY AND TOMORROW

In 1944 gasoline engines enter a new phase of progress as builders start to use American Bosch Gasoline Injection. You will hear of it again and again as we progress through Victory to the world of tomorrow.

WHAT IT IS . . . Briefly—an entirely new and different way of supplying fuel to the cylinders of a gasoline engine.

Important? Yes! Leading engineers knew that it was but a matter of time before a better fuel distribution system would become a practical reality — a system that would increase efficiency and bring extra safety.

There was a clue! Diesel engines, in their specialized way, offered high efficiency, responsiveness, safety. Would the Diesel method of injecting fuel directly into the cylinders be practicable for gasoline engines?

American Bosch knew gasoline engines from years of experience in building ignition equipment. American Bosch knew Diesels. They had engineered and built Fuel Injection Equipment for the American Diesel industry from the inception of high-speed engines.

So American Bosch engineers co-ordinated their own fund of gasoline and Diesel engine knowledge with that of forward-looking engine builders. Test installations followed. They proved a success. Gasoline Injection is today a reality.

WHAT IT DOES... *Greater, Smoother Power.* Now, the fuel is delivered uniformly to every cylinder. The result—all cylinders "pull" together in perfect harmony. And because the fuel is vaporized mechanically, all fuels, even lower grades, burn more efficiently, deliver a greater percentage of their potential power in the form of useful energy.

Greater Responsiveness. The engine responds without time lag, accelerates smoothly and performs more surely under any and all conditions.

Safety from the fire hazard of an explosive mixture in the induction system. Backfires become harmless — because all combustible mixtures are confined within the engine cylinders.

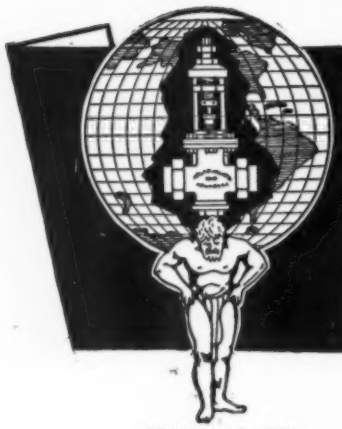
It's here — *Gasoline Injection.* Its benefits will be yours — for convenience, economy and pleasure — after Victory.

☆ ☆ ☆

AMERICAN BOSCH CORPORATION
Springfield, Massachusetts

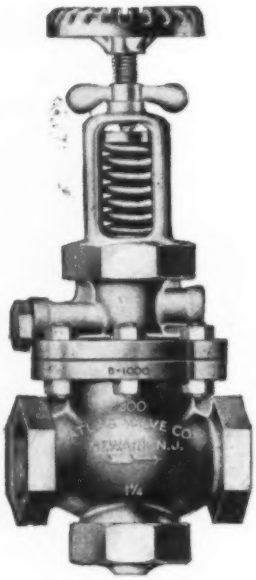
AMERICAN BOSCH

PIONEER BUILDERS OF GASOLINE INJECTION IN AMERICA



ATLAS "Type B" STEAM REDUCING VALVES

TRADE MARK REG.



for services demanding tight seating and uniform reduced pressure

Control diaphragm and controlled pressure port are integral with the valve body. The main valve is caused to open wide and close tight with slight changes in the reduced pressure through the operation of the pilot. Wide fluctuations in initial pressure have practically no effect on the reduced pressure because of the pilot operation. Renewable piston chamber, internal pilot valve, and main valve strainers. Main valve disc seats tight because disc stem is guided by center bearing cast integral with seat ring.

ATLAS Type "B" Valves are simple to maintain. Main valve disc and pilot valve are easily removed for cleaning or regrinding. The entire pilot valve can be lifted out by merely removing diaphragm cap and unscrewing pilot valve seat.

For 300 lb. Service All Bronze

Screwed or Flanged Ends—Bronze or Nickel Alloy Seats and Valves—Pilot Operated. For initial working pressures from 25 to 300 lb., saturated steam; for reduced working pressures from 1 lb. to within 20 lb. of initial pressure in one stage. Sizes: ½", ¾", 1", 1¼", 1½", 2".

For 250 lb. Service Iron Body

Flanged Ends—Bronze or Nickel Alloy Seats and Valves—Pilot Operated. For initial working pressures from 20 to 250 lb. saturated steam; for reduced working pressures from 1 lb. to within 20 lb. of initial pressure in one stage. Sizes: 2½", 3", 4", 5", 6", 8".

For 400 and 600 lb. with Temperatures to 900° F., Steel Body

Series 40 for steam service to 400 lb.
Series 60 for steam service to 600 lb.

Monel Metal, Stainless Steel and Nitralloy Seats—Stainless Steel Piston and Piston Chamber—Flanged Ends—Pilot Operated. For reduced working pressures from 1 lb. to within 30 lb. of initial pressure in one stage. Designed and built to withstand severe corrosion and wearing service under high pressure and temperature conditions. Sizes: ½", ¾", 1", 1¼", 1½", 2", 3", 4", 6".

Write for Bulletin No. 1A giving complete details.

OTHER ATLAS PRODUCTS

Check this list and mail to us with your name, firm name and address.

- ☐ Damper Regulators
- ☐ Temperature Regulators
- ☐ Exhaust Control Systems
- ☐ CAMPBELL Boiler Feed Water Regulators
- ☐ Pump Governors
- ☐ Pressure Regulators
- ☐ Float Valves
- ☐ Oil Control Cocks
- ☐ Humidity Controllers
- ☐ Thermostats
- ☐ Balanced Valves
- ☐ Control Valves

ATLAS VALVE COMPANY

REGULATING VALVES FOR EVERY SERVICE

Specialists in Regulation for Nearly a Half Century

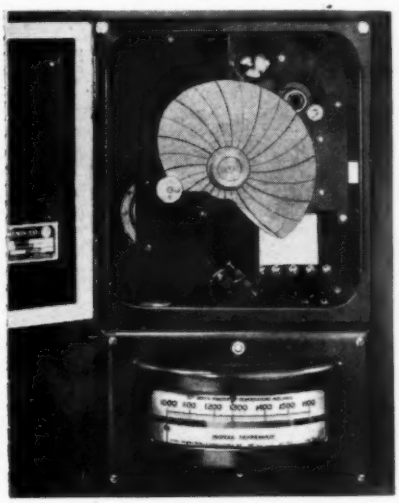
289 South St., Newark, N. J.

Representatives in Principal Cities

distribution. Cover is moisture and chemical resistant. Book device makes it possible to copy close to bindings of books and magazines. No. 1518 AP has all of the above features, plus a built-in synchronous motor automatic timer and a full-sized lightproof drawer for storing sensitized paper. *Photo Record Corp, 112 Liberty St, New York 6, New York.*

Temperature Control

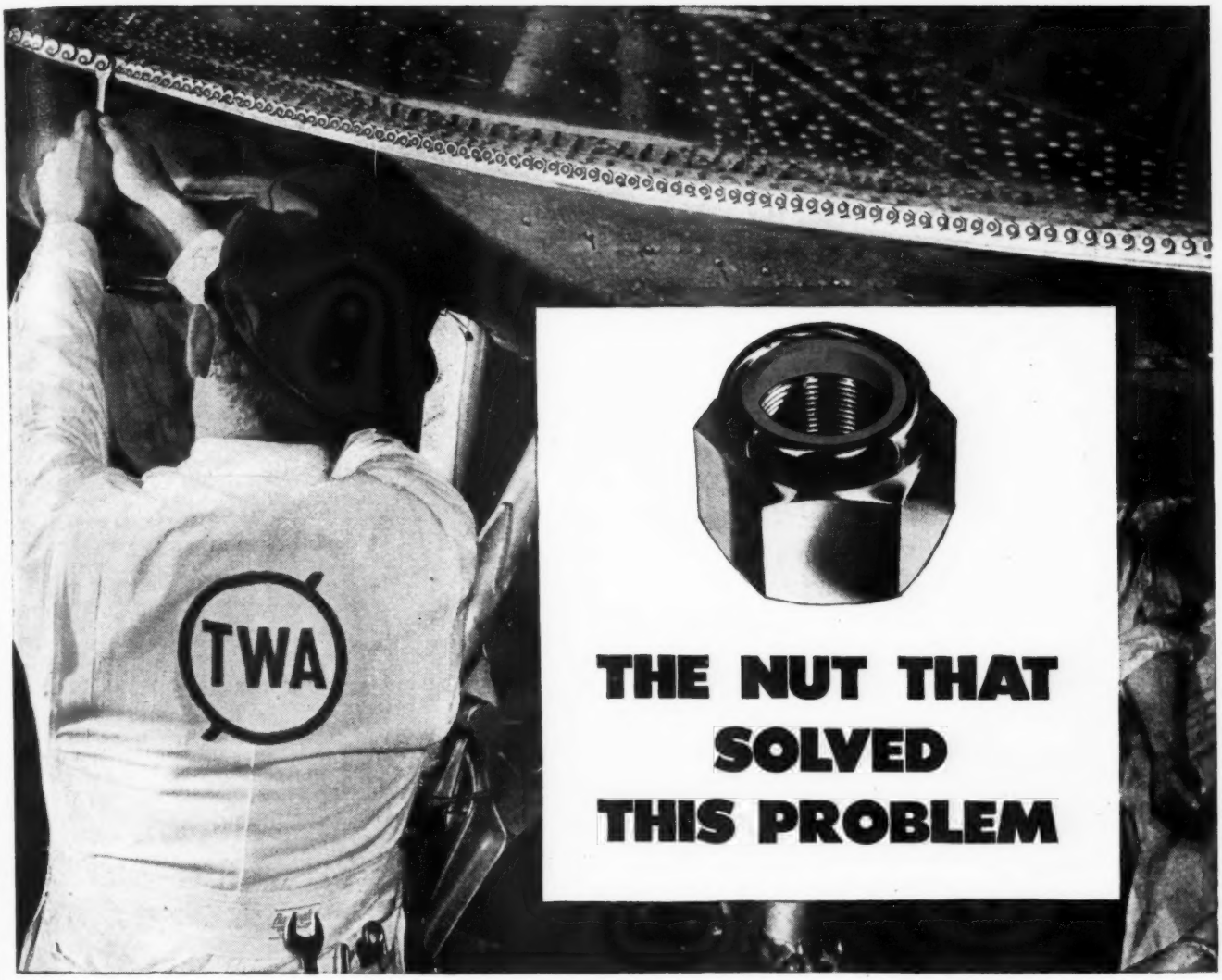
CHRONOTROLS PROVIDE completely automatic temperature regulation, regardless of temperature changes desired for a given process or application. The temperature cycle desired is cut on a disk and its rotation by a synchronous motor moves temperature setting lever of control instrument. Absence of mechanical linkage between measuring and control sections makes possible instant response of instrument's control unit to temperature changes noted by its sensing unit. When a temperature change moves control flag between



coils, it changes the frequency of the oscillating current flowing between pickup coils. This frequency change in control circuit governs output current of a vacuum tube, acting to open relay contacts which, in turn, operate fuel valves or switches. Chronotrols are offered in 25 models, including ten for proportioning control and others for 2-position on-off and 3-position on-intermediate-off control for high- and low-temperature applications. Thermometer models are available in recording as well as indicating types. *Wheelco Instruments Co, Harrison and Peoria St, Chicago 7, Ill.*

Polyvinyl Resins and Plastics

GEON 100 SERIES RESINS are special polymers of vinyl chloride characterized by their thermal and light stability, toughness and chemical inertness. Geon 101 is for electrical applications. Geon 102 is adaptable to general services. Geon 200 series of vinylidene chloride copolymers has been claimed to meet need for polyvinyls which combine increased solubility and thermoplasticity with stability, chemical resistance and wide temperature range. In common with Geon 100 series, these copolymers are



THE NUT THAT SOLVED THIS PROBLEM

How to Make Each of 328 Fastenings Carry an Equal Share of the Load

Each wing of a DC-3 transport plane is fastened on with 328 nuts and bolts.

Unless the stress and strain are distributed equally, some of the bolts shear off.

The answer was found in Elastic Stop Nuts. These nuts can be given precisely the right tension —then lock fast.

This is one of the important structural fastening jobs which Elastic Stop Nuts have solved.

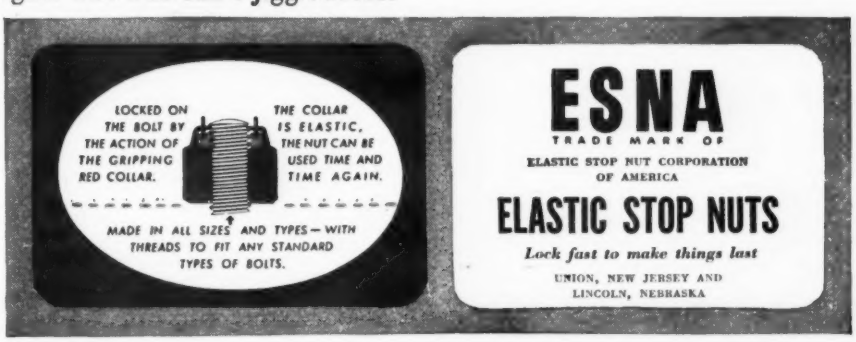
We've been told Elastic Stop Nuts, by solving many such structural fastening problems, have revolutionized aircraft construction.

These nuts lock fast—are safe. They stay tight and secure even in the face of unusual vibration. That's why they are approved for fastening such vital parts of an airplane's structure.

It's the elastic collar that does the trick. It molds itself to the bolt threads and grips them tight. The nut can't jiggle loose.

After the war ESNA nuts with the red collar will be ready to do the hard jobs of peacetime production.

Any fastening problem you anticipate will be welcomed by our engineers. They are ready to help you solve it and recommend the proper Elastic Stop Nut.


LOCKED ON THE BOLT BY THE ACTION OF THE GRIPPING RED COLLAR.
THE COLLAR IS ELASTIC, THE NUT CAN BE USED TIME AND TIME AGAIN.
MADE IN ALL SIZES AND TYPES—WITH THREADS TO FIT ANY STANDARD TYPES OF BOLTS.
ESNA
TRADE MARK OF
ELASTIC STOP NUT CORPORATION OF AMERICA
ELASTIC STOP NUTS
Lock fast to make things last
UNION, NEW JERSEY AND LINCOLN, NEBRASKA

It SPOTS WASTE While It WEIGHS

...One Way A RICHARDSON Automatic Coal Scale Saves Fuel And Money

With the aid of a Richardson Automatic Coal Scale, you can quickly pick out the coal-wasting boilers in a battery . . . remedy what's wrong *before* fuel and money are lost.

Used as units of a Richardson Coal Weighing and Feeding System, these scales accurately and indisputably record the weight of coal consumed by individual boilers; indicate uniformity of load carried by multiple pulverizers serving a single boiler.

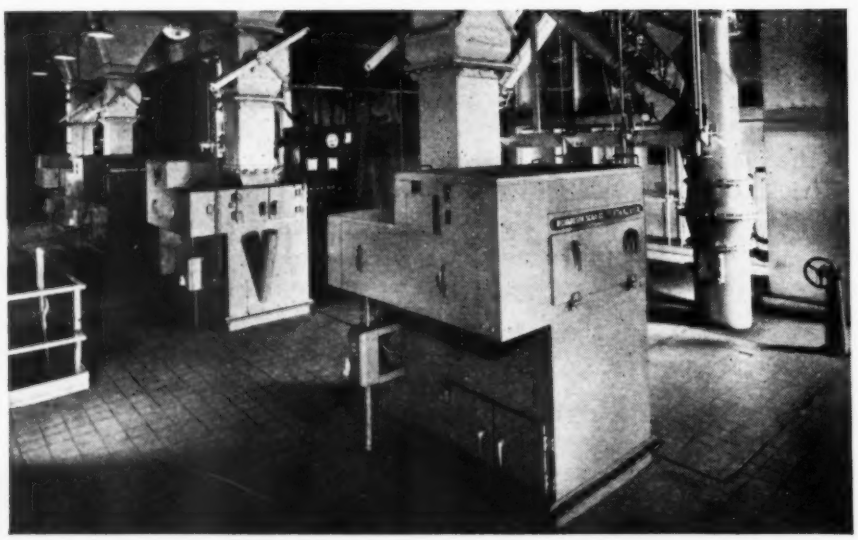
A patented Richardson feature for stoker installations is the "Monorate" Non-Segregating Distributor. A reduced section down its center improves on flat spouts, permits uniform velocity throughout. Since lumps do not turn, the cause of segregating coarse and fine lumps is removed.

Bulletin No. 1143 is packed with helpful facts and pictures. It contains forty-five pages of technical details, photographs and diagrams of installations showing Richardson systems in operation. Send for your copy.

RICHARDSON SCALE CO., CLIFTON, N. J.

ATLANTA — BOSTON — CHICAGO — OMAHA — MONTREAL — NEW YORK
PHILADELPHIA — MINNEAPOLIS — DETROIT — SAN FRANCISCO — TORONTO
WICHITA — PITTSBURGH

OST 5767



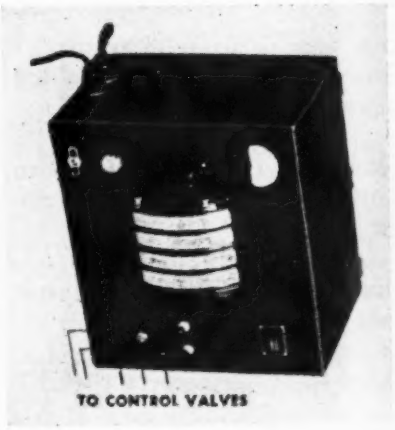
A battery of Richardson Coal Scales in operation. Equipment is compact, dustproof and needs no special attendant for continuous day and night weighing and materials handling.

said to exhibit unusual stability to light and thermal decomposition. Their resistance to hydrolysis by boiling water or even hot alkali is outstanding, according to maker. Geon 202 is a general-purpose copolymer, somewhat more soluble and thermoplastic than either 101 or 102. Geon 203 has still greater solubility and thermoplasticity. Compounded, Geon resins are for injection and compression molding, extruding, calendering, solution coating, impregnating, film casting, etc.

By proper formulation, Geon resins may be modified to produce compositions varying in properties from those of a rigid thermoplastic, through an elastomeric range, to a soft jelly. Each of plastic compositions so formed exhibits, to a high degree, the desirable characteristics of base resin. Outstanding in elastomeric range are combinations of rubber-like properties with non-flammability and resistance to oxidation. Plastics are furnished in ready-to-use compositions, of standard compounds or tailor-made formulations, in sheet form or granules. Standard compounds are for electrical insulation, fabric and paper coating, automotive and aircraft tubing, etc. *Chemical div, B F Goodrich Co, Akron, Ohio.*

Electric Manometer

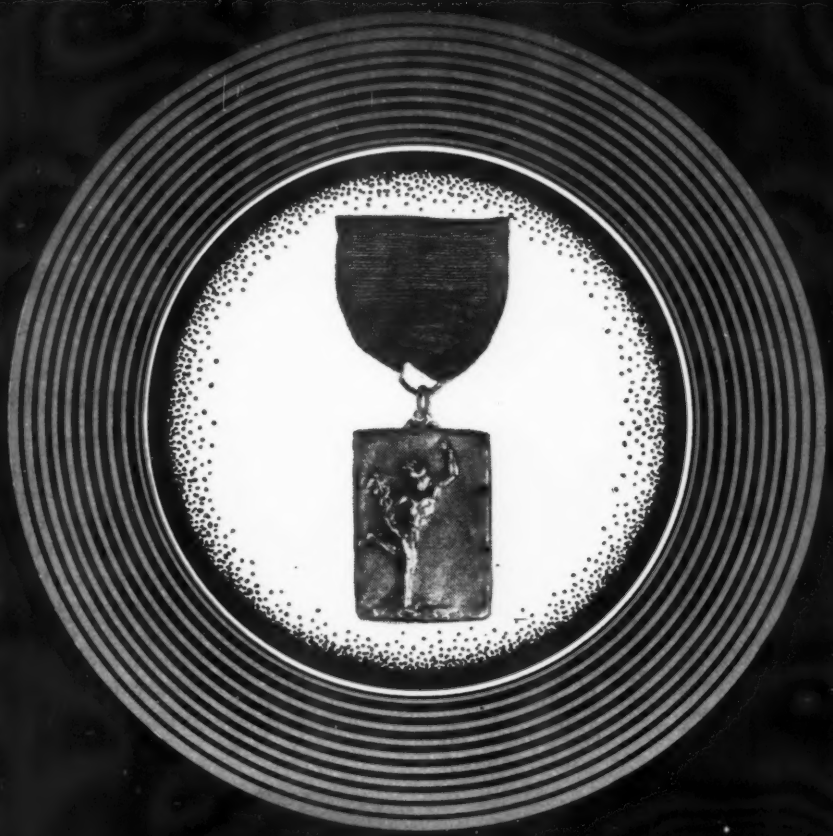
MANOMETER changes minute pressures, which might be expressed in inches and tenths of inches of water, into electrical reading. This is done by a sensitive pressure-measuring device which operates on a no-point principle utilizing a wheatstone bridge electrical circuit. Pressures are converted into actual inches and tenths readings which are on a drum-indicating unit. Instrument is said to have a 0- to 100-in. H_2O range, with a sensitivity of ¼ of $\frac{1}{10}$ of 1 in., with an accuracy of plus or minus $\frac{1}{10}$ of 1%. Unit is also available in much lower ranges of 0 to 5, 0 to 30, and 0 to 50 in. *Trimount Instrument Co, 37 W Van Buren St, Chicago 5, Ill.*



TO CONTROL VALVES

Aluminum-Bronze Electrode

DEPOSITS made with No. 100 Airco shielded-arc electrode are said to be superior to standard manganese bronze with respect to corrosion resistance, and are equal to it in strength, hardness and ductility. Airco No. 100 is for welding of malleable and cast iron, or



★ INTEREST BEFORE DIVIDENDS ★

Before a better mouse-trap can draw the world to its maker's door, many conditions must be met.

At the very beginning, the mouse-trap maker must have broad practical experience in order to develop a truly better product. Then a body of workers must be trained to maintain production in volume to equal demand. And finally—but of first importance—the interest of those workers in producing only quality mouse-traps must be encouraged.

Here at Thermoid, that employee interest in work well done receives constant stimulus from honor awards like the "Progress Medal" pictured above. From department heads to messenger girls, every Thermoid worker knows that sufficiently improved effort brings both official recognition and the applause of associates.

More important still, these honors emphasize the fact that protection of Thermoid's leadership depends upon the individual employee; and that the worker's own welfare rests directly upon continuance of that Thermoid prestige in the minds of customers and users of Thermoid Products.

This "mind to work" which marks the Thermoid family is among our most valued assets. It is largely responsible for the quality products, prompt customer attention and other things that cause folks to say: "It's good business to do business with Thermoid."

★

THE THERMOID LINES INCLUDE: TRANSMISSION BELTING • F. H. P. AND MULTIPLE V-BELTS AND DRIVES • CONVEYOR BELTING • ELEVATOR BELTING • WRAPPED AND MOLDED HOSE • SHEET PACKINGS • INDUSTRIAL BRAKE LININGS AND FRICTION PRODUCTS • MOLDED HARD RUBBER AND PLASTIC PRODUCTS.

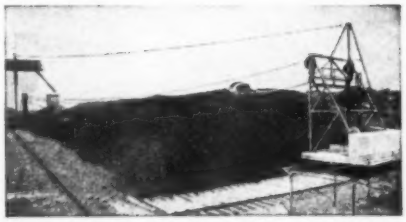
Thermoid Rubber

DON'T PUT IT OFF 'TIL TOMORROW — *Buy More War Bonds Today!*

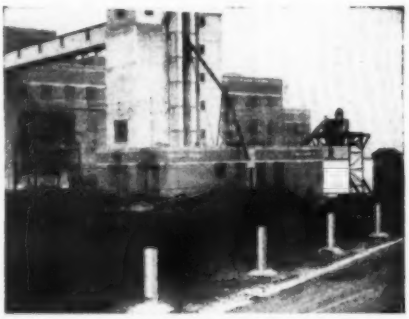
DIVISION OF THERMOID COMPANY
TRENTON, NEW JERSEY

It's Good Business to do Business with Thermoid

STORE MORE COAL NOW



(Above) Sauerman Scraper system of radial type —operated by one man—handles a 40,000-ton stock-pile on a semi-circular area 280' in radius.



Here is a Sauerman Scraper system of smaller size arranged for hand shifting of tail blocks. Powered by a 30 hp. motor, this unit stores or reclaims up to 55 tons of coal per hour.

the safe, economical

SAUERMAN way

Increased fuel storage is one of the "musts" in the production program. Plants that once were satisfied to carry a month's supply of coal now look upon six months' supply as about a minimum.

You can increase your present coal storage capacity economically, regardless of the shape or size of the available ground area, with a Sauerman Drag Scraper.

This machine is able to pile a larger tonnage safely on a given space because it stacks the coal layer upon layer to form a homogeneous pile that avoids segregation. Such a pile is practically safe from any danger of spontaneous combustion.

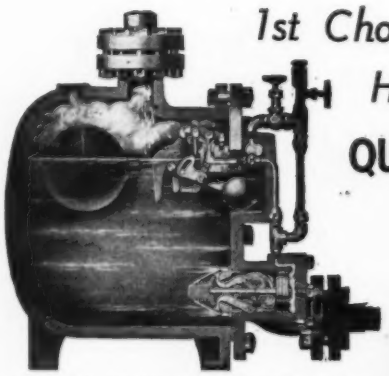
Write today for useful catalog

SAUERMAN BROS., Inc.
562 S. Clinton St. Chicago 7, Illinois

NICHOLSON STEAM TRAPS

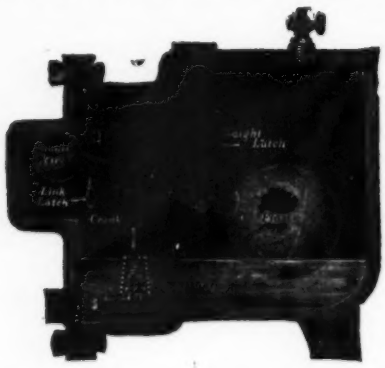
1st Choice of Engineers who Have Discovered Their

QUICK, POSITIVE ACTION



PISTON-OPERATED STEAM TRAP

1. *For pressures up to 650 lbs.*
2. *Positive, instantaneous discharge.*
3. *Non-wire-drawing valve.*
4. *Working parts of stainless steel.*
5. *Non-collapsible float.*
6. *Larger orifices.*
7. *Smaller size; larger capacity.*



WEIGHT-OPERATED Steam Trap

1. *For pressures up to 1500 lbs.*
2. *Automatic, intermittent action.*
3. *Large capacity.*
4. *Resists action of dirt, vibration.*
5. *Non-wire-drawing valve.*
6. *Water-sealed discharge valve.*
7. *Working parts of stainless steel.*

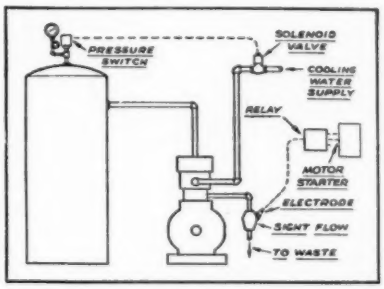
FOR COMPLETE FEATURES OF NICHOLSON TRAPS
Write for Catalog No. 941
See Our Catalog in Sweets

W. H. NICHOLSON & CO.
125 OREGON ST. WILKES-BARRE, PA.

steel, and most bronzes. Electrode may be employed for welding dissimilar metals, such as cast iron to brass, steel to malleable iron, or the joining of any two metals which are weldable with aluminum bronze. Electrode may also be used as filler rod in carbon-arc welding. Sizes from ⅛ to $\frac{5}{32}$ in. in 14-in. lengths and ¼ in. in 18-in. length are standard stock items. Sizes from $\frac{5}{32}$ to ½ in. in 18-in. lengths may be procured on special order. *Air Reduction Sales Co, 60 E 42nd St, New York 17, N. Y.*

Compressor Control

BY PERMITTING COMPRESSOR to operate only when water is actually flowing through it, control guards against failure of water supply and permits the safe use of automatic water cutoff valves. Johnson control consists of a sight-flow fitting, mounted in the water-discharge pipe of a compressor, which serves as a holder for a metal electrode. When pressure in receiver falls below predetermined level, receiver-pressure switch



opens a solenoid-controlled valve to admit cooling water to compressor. If water supply fails, compressor will not start, or if operating, will stop immediately. This arrangement is *Type M*. Control is also available as *Type U* for unloading compressors. It insures cooling-water flow before compressor starts and, if water supply fails, it stops compressor, or sounds warning alarm. Control, which is for compressors of all sizes, is entirely automatic in operation. *Johnson Corp, Three Rivers, Mich.*

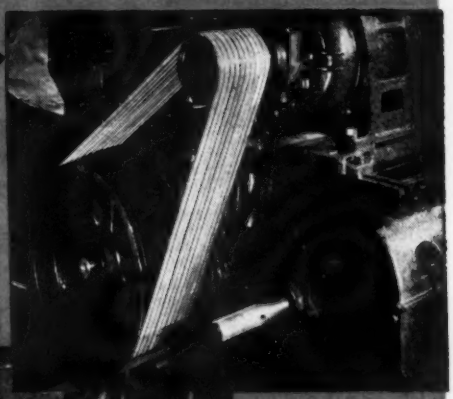
Strainer Baskets

INCREASED STRAINING AREA and rugged construction are said to be outstanding features of new baskets. They are constructed of heavy-gage perforated sheet, instead of the usual wire mesh, with various size openings. Baskets are said to withstand far greater abuse than old wire-mesh screens, which were frequently damaged during cleaning. Part of gain in straining area is achieved by spot welding, made possible by the perforated sheet. Also, this sheet eliminates the solid frame necessary to stif-

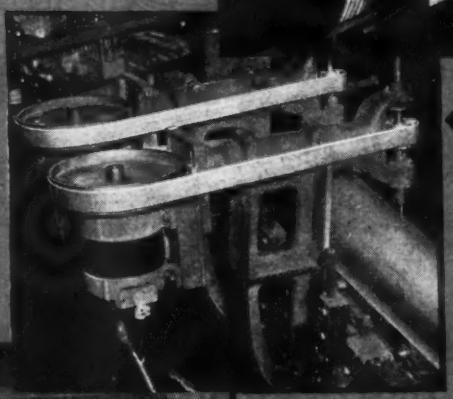
Gilmer BELTS

A COMPLETE LINE

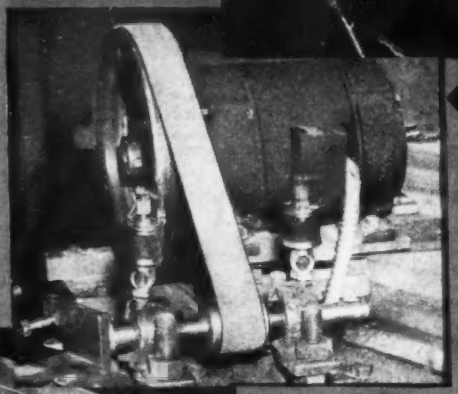
GILMER V-BELTS: Space-saving, silent, shock-absorbing belts, built to lock in the grooves with a non-slip grip. Made in standard and special sizes. Gilmer V-Belts are constructed with normalized cords to prevent excessive stretch.



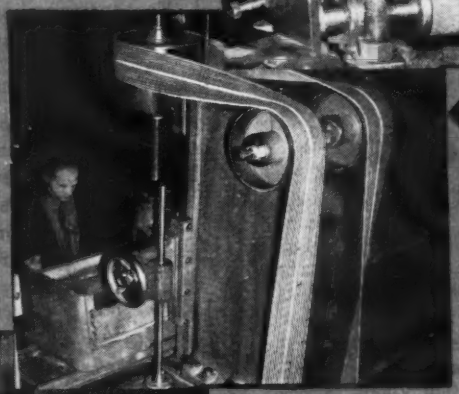
Gilmer *specializes* in belts. As the oldest firm of rubber-fabric belt specialists, with over a third of a century of experience in building power transmission belts . . . Gilmer has developed a complete line of standard Endless and Non-endless Flat Belts . . . standard V-Belts, (maintaining the largest assortment of V-moulds in the world) . . . and complete engineering and manufacturing facilities for highly specialized belts, for use wherever standard belts are unsuited. For complete information, write for a FREE copy of the Gilmer Belt Catalogue.



GILMER HEVALOID ENDLESS BELTS: Made under the Hevaloid patent with Neoprene compound that provides high coefficient of friction. For precision work at top speed of 9000 f.p.m. Resists oil, heat, stretch and slippage.

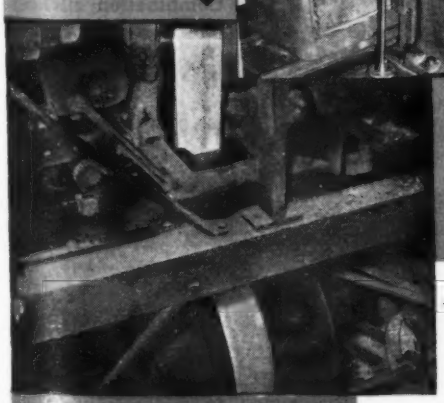


GILMER SPEEDAGE BELTS: Very light, lapless, flat, fabric belts for high speeds to 10,000 f.p.m. and over. Assures chatterfree production.



GILMER KABLE KORD BELTS: Rubber Fabric and tough continuous cord construction give you a contactor and power belt in one. Exceptional grip and strength combine in these flat belts with low-stretch, small slippage and extra tensile strength.

GILMER RHO ENDLESS BELTS: Flat endless belts, oil-resistant, jacket-enclosed. Sturdy, light and very flexible, for speeds under 7400 f.p.m.



● The Gilmer Engineering Staff has planned a National Power-Recovery Plan . . . a FREE wartime service to Industry . . . approved by the WPB . . . to save power in the following services: Steam, Gas, Water, Electricity, Mechanical Transmission, Boilers, Compressed Air, Refrigeration, and Prime Movers. Write for your FREE copy today.

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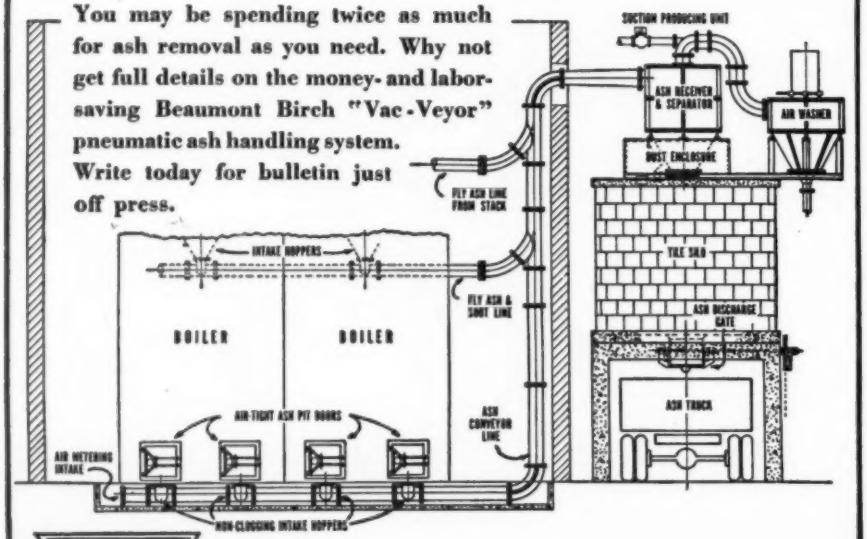
The Oldest Firm of Rubber Fabric Belt Specialists

USE WHAT YOU LOSE

HOW MUCH ARE YOU PAYING TO HANDLE ASHES?

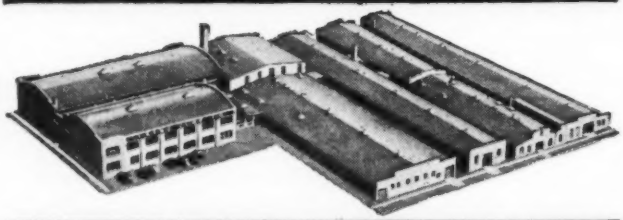
You may be spending twice as much for ash removal as you need. Why not get full details on the money- and labor-saving Beaumont Birch "Vac-Veyor" pneumatic ash handling system. Write today for bulletin just off press.



BEAUMONT BIRCH COMPANY
1505 RACE STREET PHILADELPHIA, PA.

DESIGNERS • MANUFACTURERS • ERECTORS OF COAL AND ASH HANDLING SYSTEMS

The *Real* Boss At VIKING



Is You . . and YOU . . and YOU

Viking output today is going practically 100% to the armed forces. But in the rush of War work, we haven't forgotten that this Company, which includes its own iron and brass foundries as well as manufacturing plant, grew to its present position of leadership with just one object in view . . . to more economically serve YOU, our valued civilian customers, by consistently building better rotary pumps from year to year.

We look forward to the return of Peace when we shall again be privileged to build dependable Viking Rotary Pumps for civilian customers, large and small, in many industries . . . . to provide the same reliable, efficient Viking service you have been accustomed to. Until that day, please accept our sincere thanks for your continued patience and courtesy under today's trying conditions.

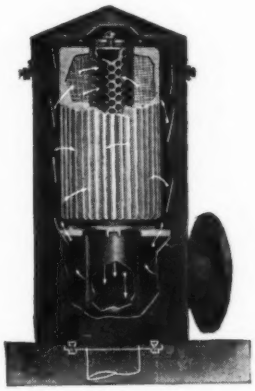
If you have a Viking Pump, please keep it in good shape as long as possible. The Viking Service Manual offers valuable pointers. Write for your FREE copy today. If you are interested in new pumps for post-war service, write for Catalog 42-G, illustrating the complete Viking line. It is FREE for the asking.

VIKING Pump COMPANY
CEDAR FALLS, IOWA

fen the old wire-mesh screen, thus permitting liquids to flow more freely through unit. New perforated baskets for all Ezy-Kleen strainers. *Blackmer Pump Co, Grand Rapids, 9, Mich.*

Wheeled Extinguishers

KIDDE MODEL 100 wheeled fire extinguishers, with a non-conducting plastic nozzle shield, combine quick mobility of portable units with fire-fighting power of 100 lb of highly compressed carbon dioxide. Shielded nozzle is equipped with a long handle grip and a shutoff valve which permits gas conservation during changes of fire-fighting position. Large-wheeled extinguishers protect against oil and electrical hazards in power plants, as well as oil-pumping stations, large storage spaces, etc. *Walter Kidde & Co, Belleville, N. J.*



Intake Filter

FOR COMPRESSORS and internal-combustion engines, Staynew IDR intake filter may be installed and subsequently serviced at ground level in engine room, while air-intake opening may be located elsewhere. Filter provides all advantages of Staynew and Protectomotor dry-intake filters, including radial-fin construction. Servicing is simple, as filter lifts out through removable panel and is cleaned by brushing, compressed air or washing. Combination silencer-and-filter models are available. *Dollinger Corp, Rochester, N. Y.*

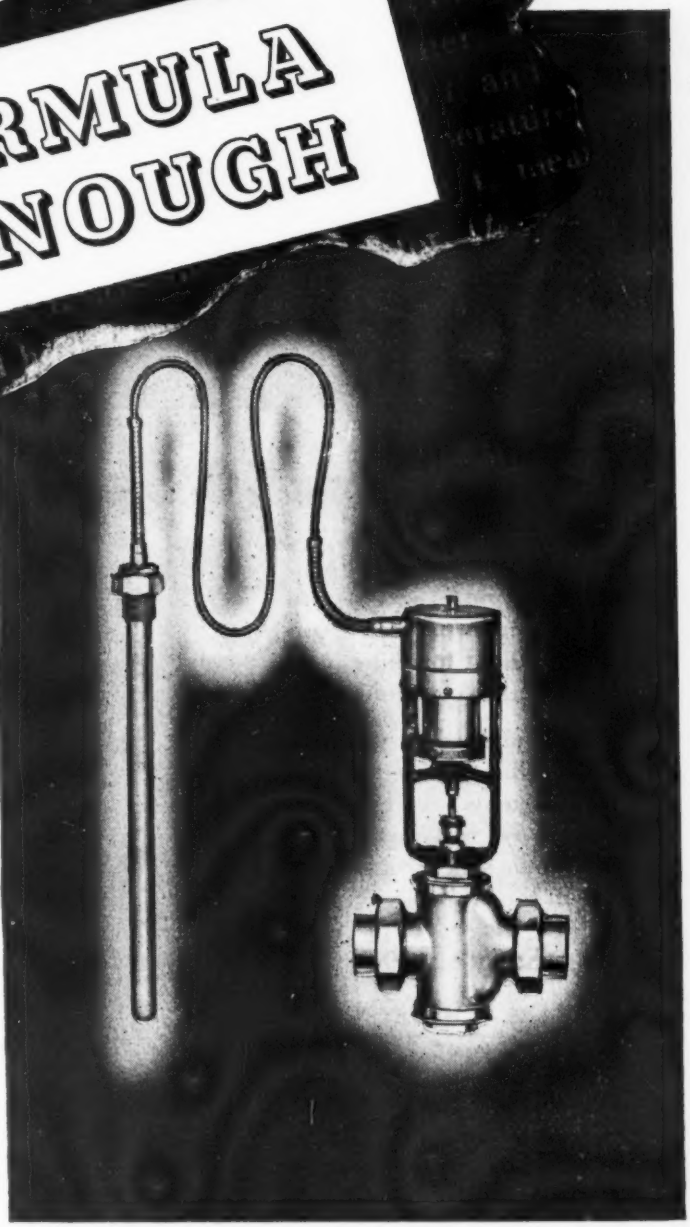
Iron Cement

FIX-IRON REPAIRS broken, cracked or defective metal castings, piping, etc. It makes joints, seams and loose parts secure and stops leaks in boilers, furnaces, fire pots and other metal equipment. Fix-Iron is a powder that is mixed with water before application. It requires no heat. After metallizing, Fix-Iron is claimed to possess the same expansion and contraction properties as

$$Q = \frac{(19.350 \times F) - 2545}{2}$$

THE FORMULA ISN'T ENOUGH

about one-half of the total



REGARDLESS how accurately heat-transfer factors have been worked out, no Diesel cooling system is complete without automatic temperature control.

Experience has clearly shown that for long life, lowest maintenance cost and highest BHP/Gal. FO, jacket temperatures *must* be constant—and with as small a differential between cylinder head and the lower portion as possible. The temperature rise between the coolant intake and outlet should also be as small as possible. These requirements are especially true of vapor-phase cooling systems, where engines are run at jacket temperatures as high as 240°F.

As pioneers in the field of automotive temperature regulation, the Fulton Sylphon Co. quite naturally developed a line of automatic regulators especially designed for Diesels. They are standard equipment on many units, and models are available for easy installation on engines now in service.

Some of these instruments are designed to stop the engine if oil pressure drops or jacket temperature rises dangerously. Special instruments to solve individual problems can be produced. Bulletin LS-817 describes standard Sylphon Regulators for Diesel applications.

No. 923 for automatically controlling the volume of coolant flow. An extremely neat, compact instrument—ideal for standard equipment.

FULTON SYLPHON

TEMPERATURE CONTROLS — BELLOWS — BELLOWS ASSEMBLIES

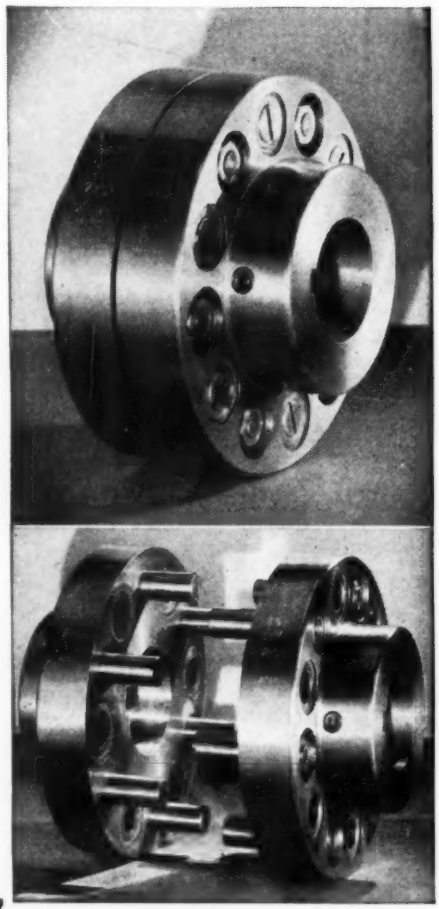
THE FULTON SYLPHON CO., KNOXVILLE 4, TENNESSEE

Try This for 10 Seconds

Just take a couple of pencils right now and try to hold them in perfect alignment without touching each other while you count 10.

Remember that you are making this 10 second test with pencils weighing a fraction of an ounce. At the same time, remember that all the horsepower goes through the coupling connecting heavy machines running at high speed hour after hour.

Ajax Flexible Couplings have been doing this job for over 20 years. They do it without lubrication because of their rubber bushed, graphited - bronze bearings and interlocking drive studs. Write for the facts on Ajax Flexible Couplings.



AJAX

FLEXIBLE COUPLING CO.

Incorporated 1920 **WESTFIELD, N. Y.**

iron itself, thus assuring a permanently tight joint regardless of temperature changes. It may be applied on wood also. *So-Lo Works, Loveland, Ohio.*

Photoelectric Colorimeter

LUMETRON COLORIMETER 400-A is equipped with a jewel-bearing indicating instrument which gives immediate readings. Lamp, 50 cp, 110 v, actuated by a pushbutton, is turned on only when readings are taken. Sliding test-tube carrier makes it possible to check correct setting of instrument before taking a reading without exchanging tubes. Sample holders are full-length test tubes. Voltage stabilizer is furnished as a separate unit. *Photovolt Corp, 95 Madison Ave, New York 16, N. Y.*

Synthetic Rubber Gloves

LIGHTWEIGHT SYNTHETIC RUBBER glove is of .15-in. gage, 10½-in. length. Sizes, in halves, range from 7 to 11. Second model is of .30-in. gage, 14-in. length, in sizes 10, 10½ and 11. Heavier glove is available only in straight-finger style. Company states synthetic rubber gloves are as good as natural rubber gloves in resistance to acids, grease and oil. Gloves can be sold to anyone qualifying under Rubber Order R-1. *B F Goodrich Co, Akron, Ohio.*

Dissolved Oxygen

(*Continued from page* 68)

3. Pour Winkler sample into titrating beaker.

4. Adjust speed of motor-driven stirrer to produce as much agitation as possible without vortex action.

5. Add 1 cc of starch solution as an indicator.

6. Fill the 1-cc microburette with standardized potassium bi-iodate solution and allow it to drain to waste. This washes the burette without danger of diluting the solution.

7. Refill the microburette with bi-iodate and add a known amount to the sample. If starch indicator does not turn blue add enough bi-iodate to produce a definite blue color and record the exact amount added.

8. Fill the other 1-cc microburette with standardized sodium thiosulphate solution and allow to drain to waste.

9. Refill the microburette with thiosulphate.

10. Add thiosulphate to the sample until blue color just disappears, and record the quantity added.

11. Allow about one minute for thor-

WHAT YOU WANT *for Piping* WHERE YOU WANT IT

You can get materials for any piping requirement from Grinnell warehouses in the cities listed here. Included are practically every type of materials for simple or complex piping installations. At these Grinnell branches, experienced engineers will assist you to solve any unusual piping problem.

Grinnell piping products are available from your local Grinnell jobber. Send for catalogs and remember Grinnell "whenever Piping is involved".

GRINNELL COMPANY, INC.
Executive Offices: Providence 1, R. I.

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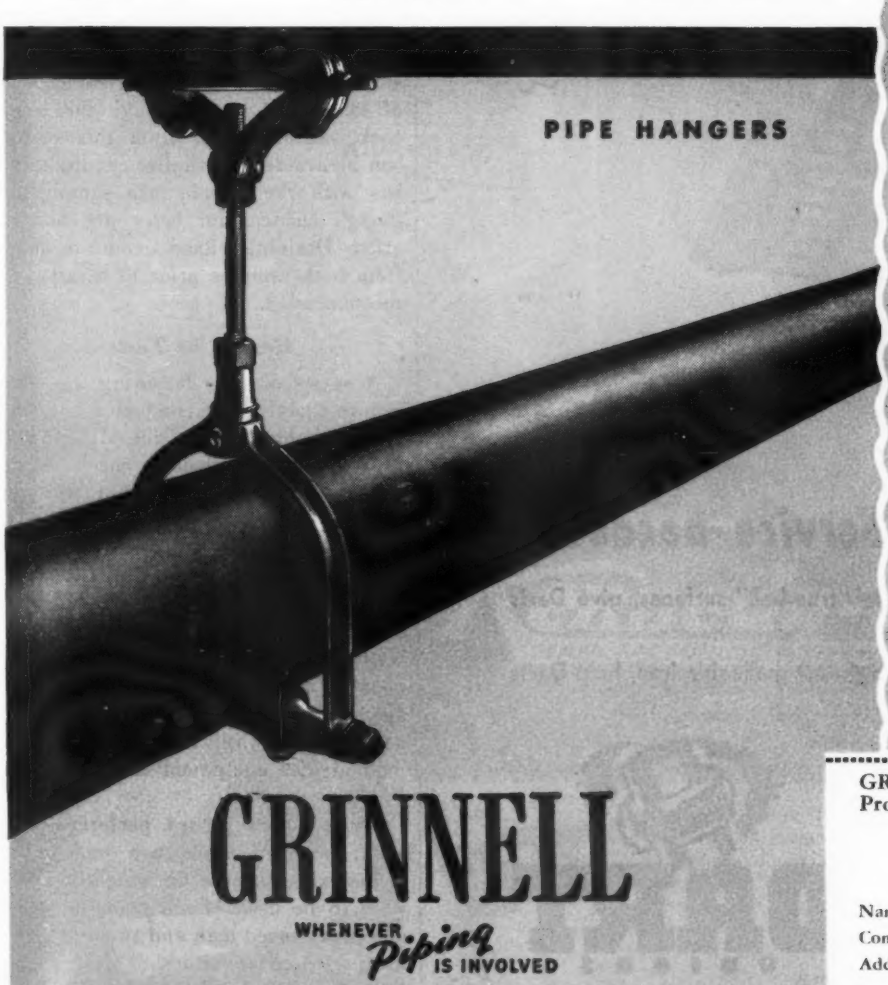
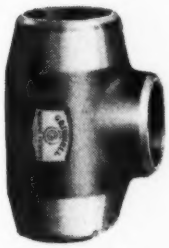


GRINNELL

WHENEVER *Piping* IS INVOLVED

Cast Iron, Malleable, Bronze and Steel Pipe Fittings

Pipe Hangers



Welding Fittings

Pre-Engineered Spring Hanger

Grinnell-Saunders Diaphragm Valve

Also Pipe – Valves – Specialties for Heating, Water Works, Fire Protection and Pulp and Paper Mills.

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Please send copy of Catalog describing
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Grinnell-Saunders Valves .

Name ..... Title .....
Company .....
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Old Darts
Pack in Plenty of Service because*

*Matched bronze seats, ground to "true-ball" surfaces, give Darts their longer life.

*Dart Bodies and nuts, made of high-test malleable iron, help Darts resist rough handling and rust.

Start a search for old Darts in your plant now. It's profitable—and it helps the war effort.

P. S. If you can't find enough Darts to meet your needs, see your supplier for new Darts.

DART UNIONS LIVE LONGER

DART UNIONS

E. M. DART MFG. CO. **PROVIDENCE, R. I.**

ough mixing and for chemical reactions to be completed, then read voltage across the electrodes.

12. Wash the 0.2-cc pipette with thiosulphate and refill as described for the burettes.

13. Add thiosulphate solution in 0.01-cc increments and read voltage across electrodes between each addition.

14. End point of titration is reached when the change in voltage between successive additions reaches a maximum.

15. Follow the same procedure for the interference sample and record all data on a standard form for ease in detecting irregularities in the test.

This procedure is believed to be a minimum for reliable testing. Two possible sources of error are involved requiring additional steps for greater surety. First, some mixing of reagents in air before introduction info the sample is inevitable. By washing tube extensions of the McLean flasks with deaerated water after adding each reagent, Fig. 8, contamination from mixing is eliminated.

Secondly, contamination of the sample by unfixed reagents trapped in the bore of the stopcocks is possible. In the Winkler sample, a mixture of No. 1 and 2 reagents is trapped in one of the stopcocks. By draining a known amount of sample to waste through this stopcock, contamination from this source can be avoided. A similar condition exists with the interference sample although chances for error are not so great. Draining a fixed amount to waste from both samples prior to titration is recommended.

Results of Tests

A series of tests following this procedure exactly were conducted to establish probable error, Table III. Additional tests were made to check the effect on test accuracy of (1) washing tube extensions of the McLean flasks with deaerated water after adding each reagent, Fig. 8, to avoid contamination from mixing reagents in air and (2) draining a known amount of sample to waste to purge the stopcock bore that contains a mixture of No. 1 and 2 reagents. Titration of all samples was accomplished by the potentiometric method with equipment arranged as in Fig. 10.

Three 3-man groups performed the tests; none of these men was aware of the exact purpose for which the tests were to be used. Each team included one experienced man and two relatively inexperienced operators.

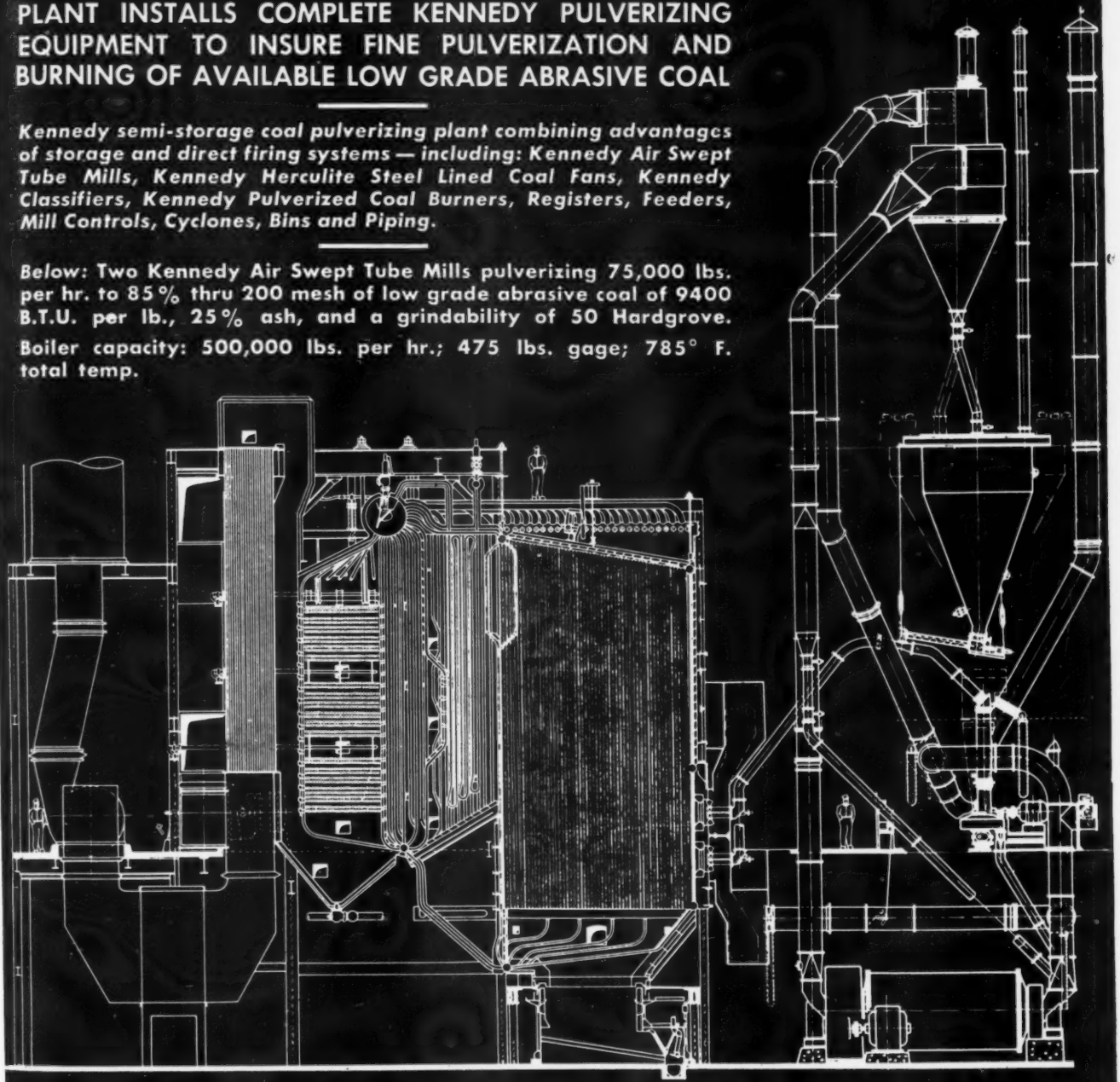
Tests were of sufficient length to include a minimum of 40 and a maximum

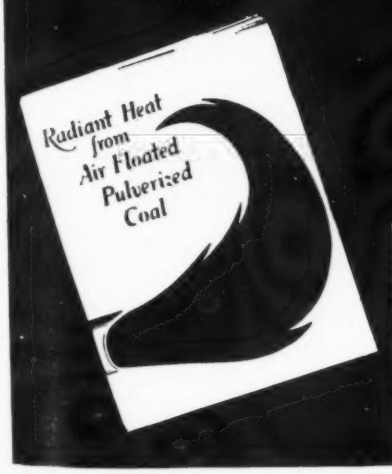
BURNING LOW GRADE COAL

PLANT INSTALLS COMPLETE KENNEDY PULVERIZING EQUIPMENT TO INSURE FINE PULVERIZATION AND BURNING OF AVAILABLE LOW GRADE ABRASIVE COAL

Kennedy semi-storage coal pulverizing plant combining advantages of storage and direct firing systems — including: Kennedy Air Swept Tube Mills, Kennedy Herculite Steel Lined Coal Fans, Kennedy Classifiers, Kennedy Pulverized Coal Burners, Registers, Feeders, Mill Controls, Cyclones, Bins and Piping.

Below: Two Kennedy Air Swept Tube Mills pulverizing 75,000 lbs. per hr. to 85% thru 200 mesh of low grade abrasive coal of 9400 B.T.U. per lb., 25% ash, and a grindability of 50 Hardgrove. Boiler capacity: 500,000 lbs. per hr.; 475 lbs. gage; 785° F. total temp.





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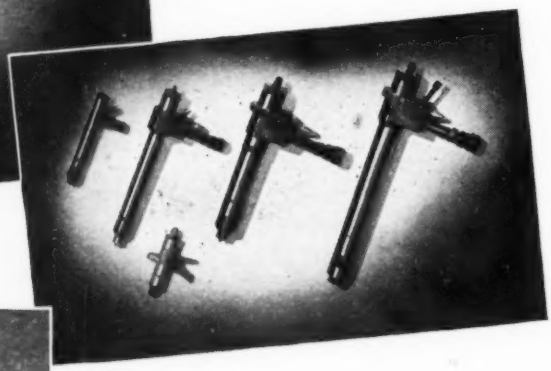
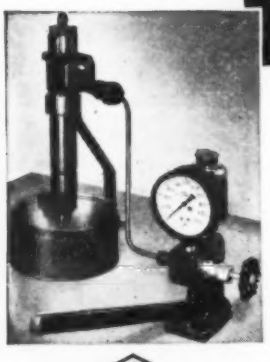
Adeco equipment is engineered to secure the optimum performance of the engine you are building or plan to build. Today's line of fuel injection pumps, nozzles and nozzle holders is the most dependable in Adeco history—the result of years of pioneering and research for the diesel industry. Their performance speaks louder than words in pointing the way to the finest in diesel fuel injection equipment.





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America's most widely used Nozzle Tester enables any mechanic to make quick, accurate tests on injector opening pressure, spray pattern, etc., and detect stuck needle valves and leakage around valve seats. Compact, portable, sturdy, precision-built. Pressures up to 10,000 p.s.i. Tests both large and small injectors. Avoids costly delays and possible damage to engine. Also obtainable with Navy-approved gauge. Write for bulletin.

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AIRCRAFT & DIESEL EQUIPMENT CORPORATION

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of 60 individual samples and were run under field conditions. Tests 1 to 5 sampled water from a medium-sized deaerator operating under controlled conditions. Tests 6 and 7 were performed under similar conditions except that a considerably larger deaerator was used.

Table III reports the statistically calculated *first probable error* for each test series. Definite improvement is indicated in accuracy for washing flask ends and for draining unfixed reagents trapped in the stopcock bore. The inherent error of test procedure No. 1 clearly shows how unreliable dissolved oxygen tests can be even with a carefully planned and well-executed procedure.

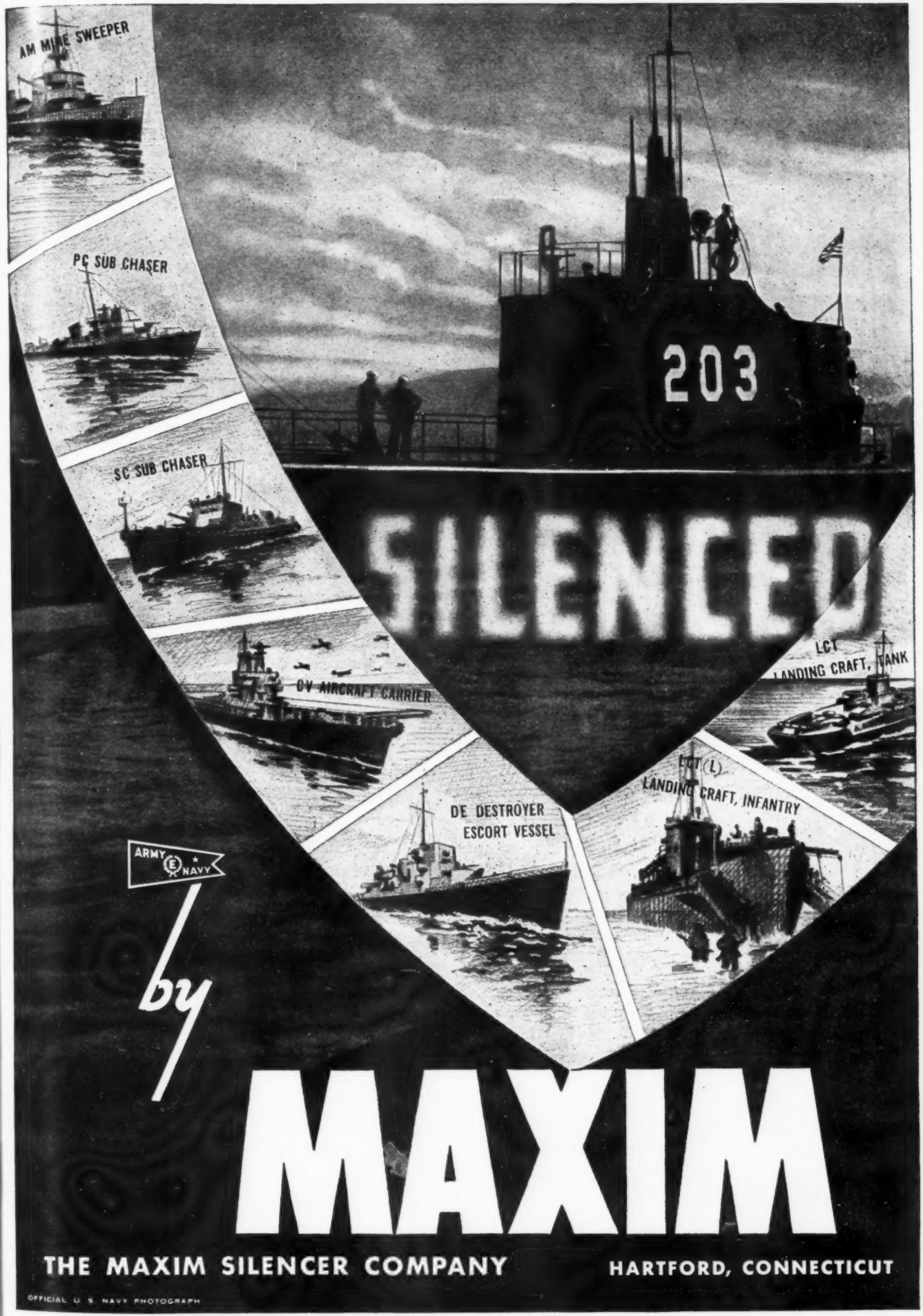
A comparison of tests 6 and 7 seems to indicate that there is no difference in the inherent accuracy of the Schwartz Gurney "A" modification of the Winkler test and the U. S. Navy procedure. As a point of interest, the difference between the absolute values obtained from these tests was slightly greater than the first probable error in this particular experiment. Test 6 used McLean flasks with integral tube extensions, while flasks having separate reagent cups were used in Test 7. Little or no advantage appears to be gained by use of the separate reagent cups.

If test procedure 3 is carefully executed with the apparatus described, 50% of the test readings can be expected to fall within the first probable error, or approximately within $\pm$ 0.001 cc per liter of dissolved oxygen. After eliminating irregularities in a given test setup and procedure, variation in oxygen content greater than this amount can be attributed to the deaerating conditions.

While a complete description of test procedure is necessarily long and involved, actual performance of the test becomes quite simple. A 2-man team can easily average three tests an hour and a 3-man team about four per hour. Test procedure can be applied to any of the several modifications to the basic Winkler test and comparable accuracy to that reported in Table III can be obtained if apparatus is properly selected and the procedure carefully executed.

Editor's note: Part III detailing apparatus, chemicals and procedure for a typical test will appear in July POWER.

U. S. Maritime Commission awarded to Joshua Hendy Iron Works a contract for 74 diesel engines. They will be built at the Sunnyvale, Calif., plant and will be combined with generators constructed by the Crocker Wheeler div to supply diesel electric auxiliary power for AV-I vessels.


AM MINE SWEEPER
PC SUB CHASER
SC SUB CHASER
203
SILENCED
AV AIRCRAFT CARRIER
LCT
LANDING CRAFT, TANK
DE DESTROYER
ESCORT VESSEL
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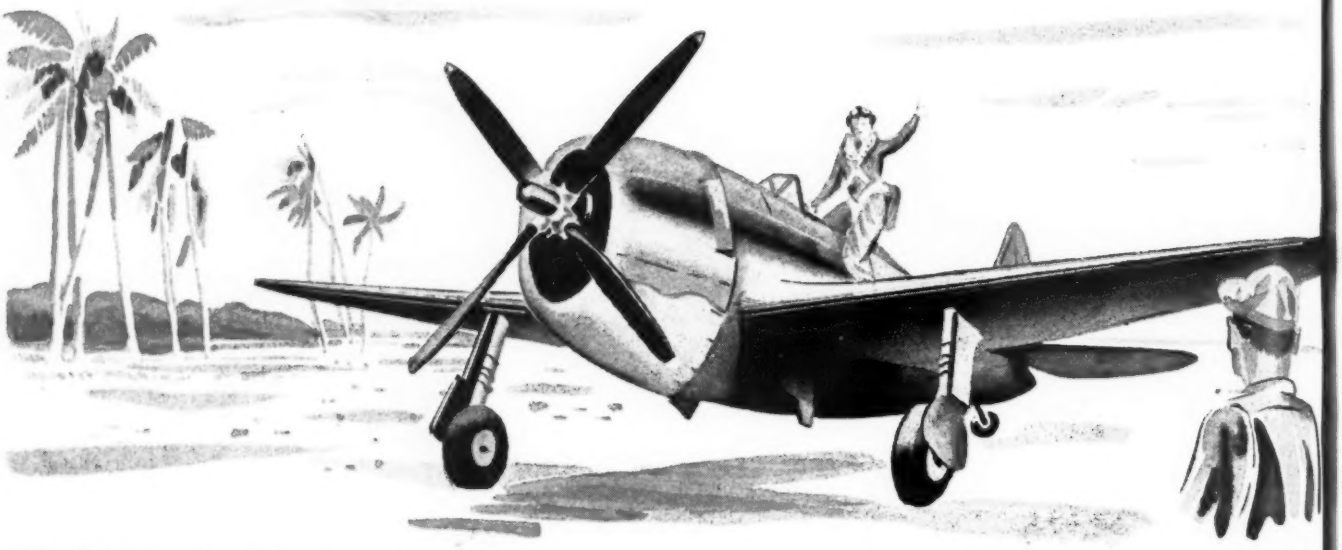
The Army's Answer to a "MUST!"



"Thunderbolt"—said to be the most powerful single seat fighter in the world, with four .50 caliber fixed machine guns mounted in each wing panel, a flying speed of 400 m. p. h. plus—and a diving speed greater than the speed of sound.

To be victorious in modern warfare, an army must not only have enough planes but they must be planes of many types. Each of these must satisfy all the functional requirements peculiar to the service in which it will be used.

"Musts" are just as constant in industrial, as in military achievements. And the only "stock-bin" out of which "musts" are solved is the stock-bin of experience and specialized application.

POWELL, for nearly one hundred years, has made valves, and valves only . . . valves for all flow control requirements . . . valves for the "must" requirements in all fields of industry . . . in war or peace . . . through nearly ten decades of industrial progress. Our experience in producing *the* valve to do *the* specific job—"to meet the must"—is yours on request.

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Fig. 150 (below)—Bronze "Union Disc" Globe Valve for 150 pounds W. P. Has screwed ends, union bonnet, and renewable vulcanized composition disc—especially adapted for throttling service—for the control of low-pressure steam, oil, water, gas, etc.

Fig. 375 (above)—Bronze Gate Valve for 200 pounds W. P. Has screwed ends, union bonnet, inside screw rising stem and a special hard bronze disc.

Fig. 1708 (below)—Bronze Globe Valve for 200 pounds W. P. Has screwed ends, union bonnet, renewable seat and regrindable, renewable hard bronze semi-cone plug type disc—especially adapted for throttling service—for the control of low-pressure steam, oil, water, gas, etc.

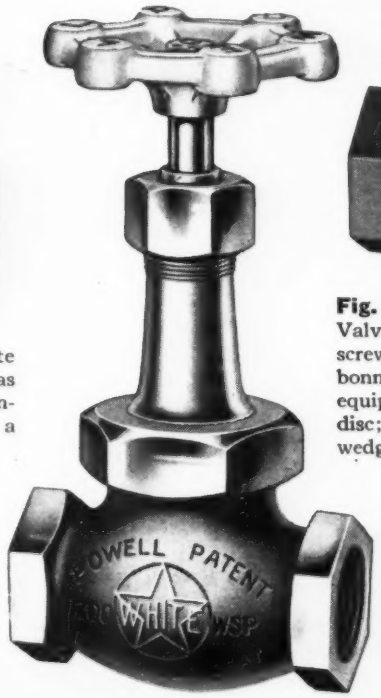
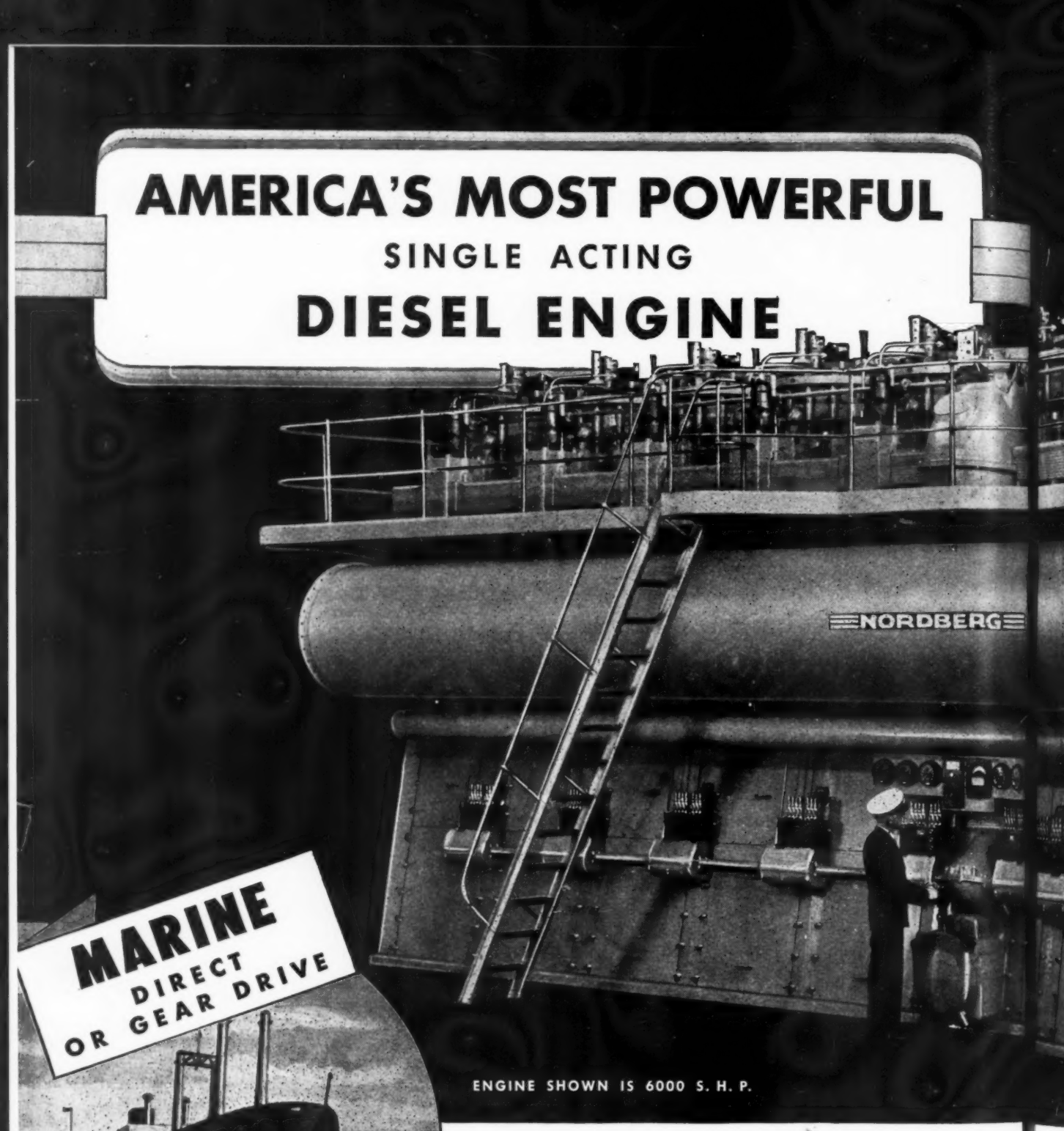


Fig. 500 (above)—Bronze Gate Valve for 125 pounds W. P. Has screwed ends and screwed-in bonnet. Sizes ¼" to ¾" are equipped with taper wedge solid disc; sizes 1" to 3" with taper wedge double disc.

VALVES

AMERICA'S MOST POWERFUL
SINGLE ACTING
DIESEL ENGINE

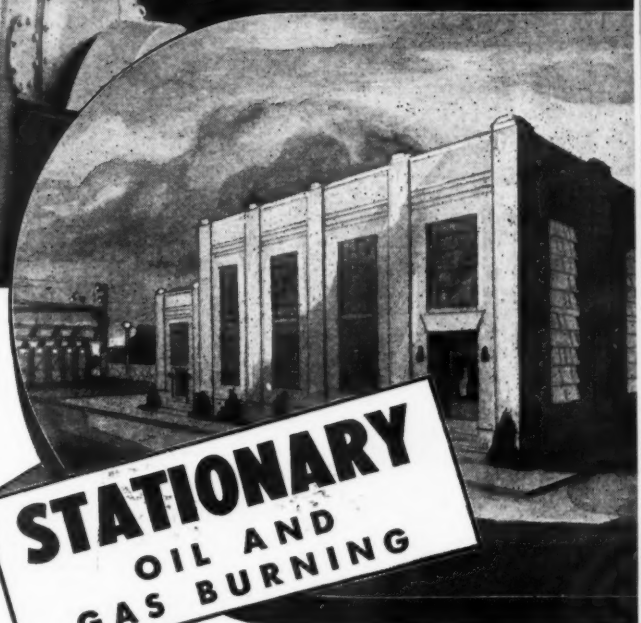


ENGINE SHOWN IS 6000 S. H. P.

MARINE
DIRECT
OR GEAR DRIVE

Direct reversing marine engines of this type are available in sizes from 4000 to 8000 shaft horsepower at 160 R. P. M., for direct drive in single or twin screw; also twin engine, reduction gear single screw vessels. Reversing and speed controls are centered in a single lever.

NORDBERG DIESEL E



STATIONARY
OIL AND
GAS BURNING

Stationary engines are available in sizes from 3000 to 6000 KW per unit. Exhaustive tests with mechanical injection system show excellent performance on low grade, high viscosity, fuel oils. These engines may also be equipped to operate on natural gas with Diesel efficiency.

ENGINES

NORDBERG MFG. CO.
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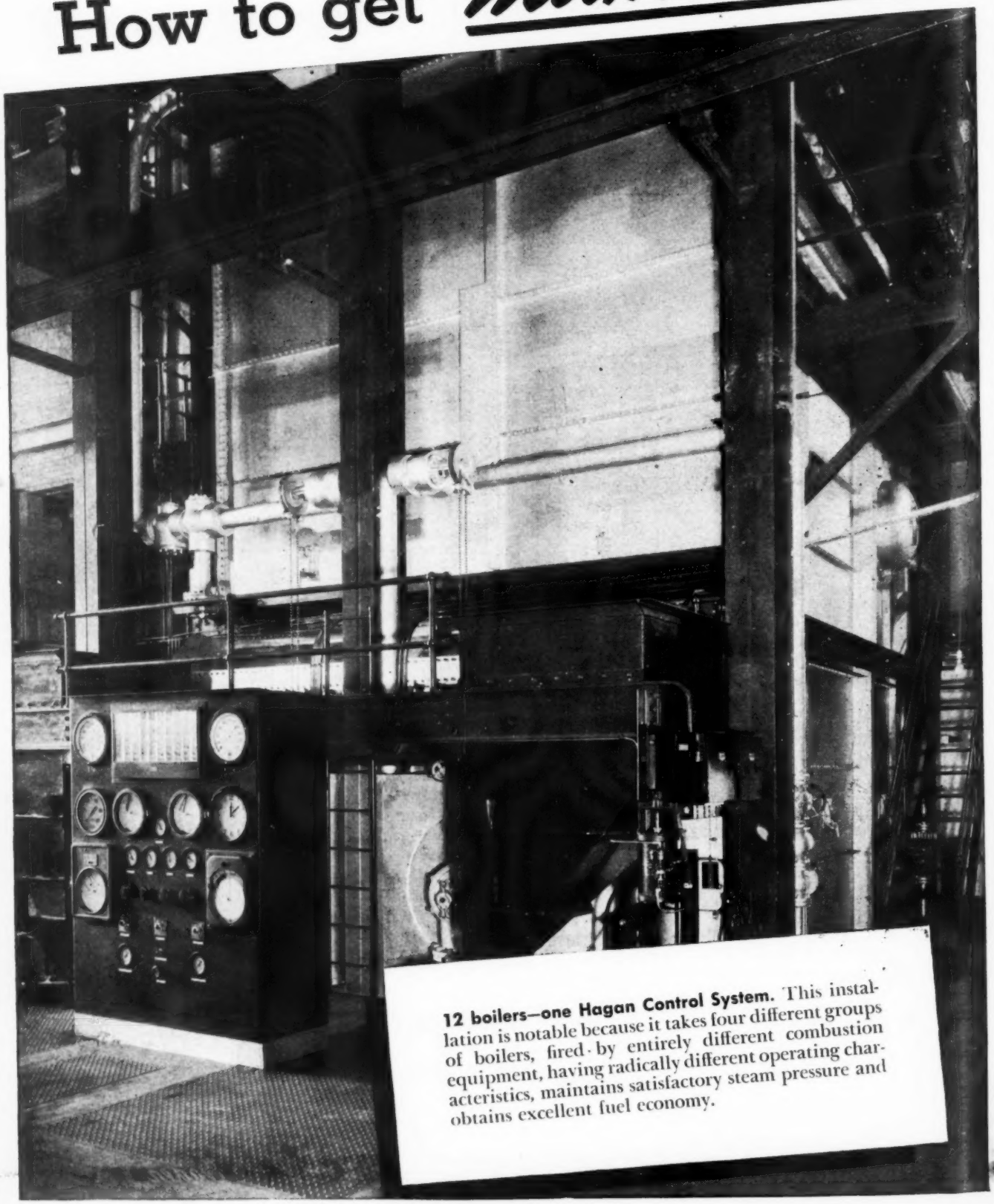
How to get *maximum*



12 boilers—one Hagan Control System. This installation is notable because it takes four different groups of boilers, fired by entirely different combustion equipment, having radically different operating characteristics, maintains satisfactory steam pressure and obtains excellent fuel economy.

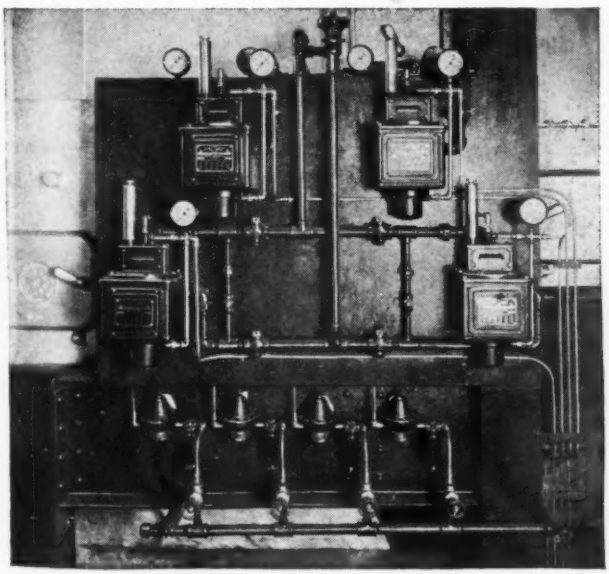
combustion efficiency

. . . and obtain highest steam output for every pound of fuel.

HAGAN Automatic Control is "made to order" for war conditions. It maintains highest efficiency with little attention from the operating staff. It gives new men a chance to learn boiler operation without wasting large quantities of fuel in the training process.

The increased efficiency you will get depends upon your present plant conditions. This much is certain. Hagan Control, by keeping all auxiliaries regulated for the highest efficiency, *will obtain maximum steam from every pound of fuel you burn.*

This Hagan efficiency is directly due to superior engineering and exclusive Hagan features. It began 26 years ago when Hagan was first to recognize the need for incremental control—that is, a control that would operate in accordance with the demand for steam. It followed step by step in this lead, coming out *first* with practically every notable improvement. It *is* first in the field today. Get the facts about it.



87.3% overall operating efficiency was obtained by this Hagan Control in a medium-sized power plant. The station is under continuous operation and burns mid-western coal.

HAGAN CONTROL ASSURES

MAXIMUM QUANTITY of steam from any given plant, by introducing fuel and air in correct proportion for utmost efficiency.

MAXIMUM UTILIZATION value, uniform steam pressure in accordance with demand.

MAXIMUM OUTPUT from boilers of different capacities, automatically.

MAXIMUM PROTECTION of auxiliary equipment, fans, stokers, etc., by maintenance of uniform operating conditions.

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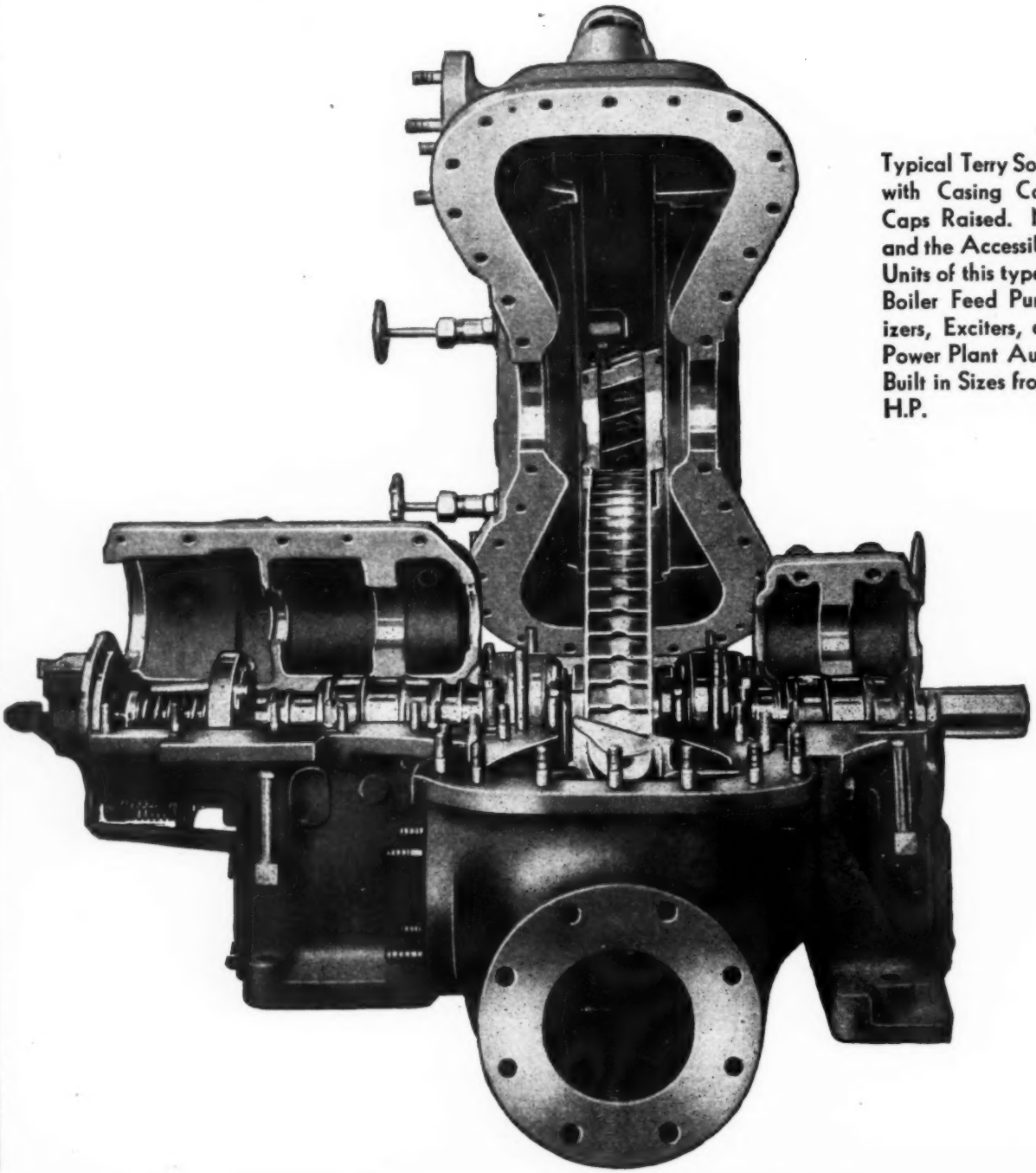
HAGAN *Automatic* COMBUSTION CONTROL

The pioneer. . . and still the leader

The TERRY

FOR AUXILIARY DRIVE



Typical Terry Solid Wheel Turbine with Casing Cover and Bearing Caps Raised. Note Ruggedness and the Accessibility of All Parts. Units of this type are used to drive Boiler Feed Pumps, Coal Pulverizers, Exciters, and All Types of Power Plant Auxiliary Equipment. Built in Sizes from 5 H.P. to 2000 H.P.

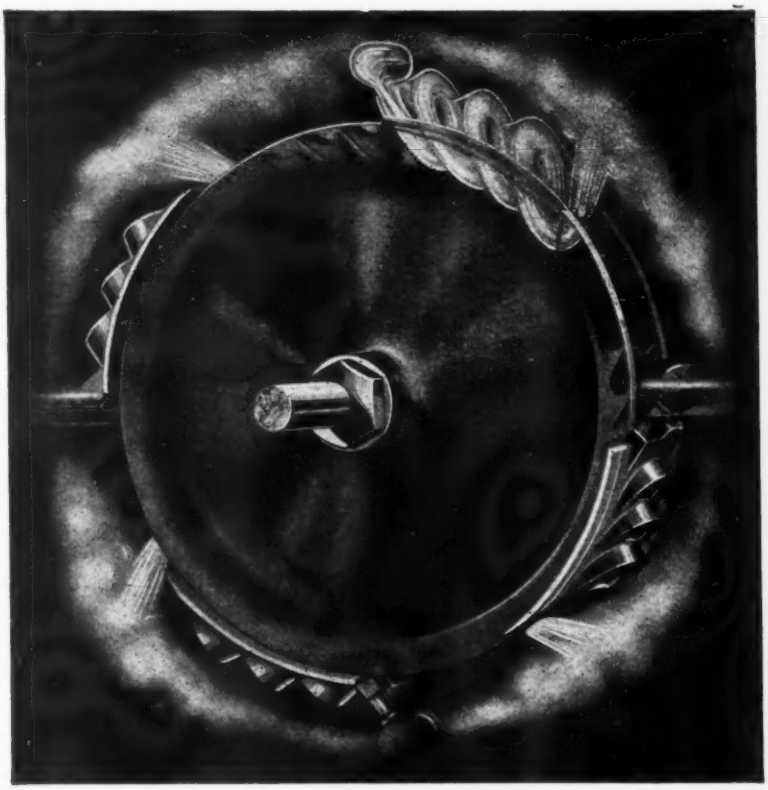
THE TERRY STEAM TURBINE CO.

Wheel Turbine

OFFERS MANY ADVANTAGES

ROM THE SMALLEST TO THE LARGEST, HESE RELIABLE TURBINES HAVE —

- Indestructible One Piece Wheel
- Large Radial and Axial Clearances
- Double Rim Protected Blading
- Dependable and Durable Governor
- Heavy Dust-Proof Bearing and Governor Housing
- Independent Overspeed Trip with Separate Valve
- Sturdy Casing Design
- Strong and Easily Inspected Steam Strainer
- Sight Oil Level Gauges
- Individual Nozzle Control
- Truly Accessible Construction, Which Makes Inspection of the Interior Parts a Simple Matter



Action of steam in Terry wheel turbine. The steam issues from an expanding nozzle at high velocity and enters the side of the wheel bucket in which its direction is reversed 180°. As this single reversal uses but a portion of the available energy, the steam is caught in a stationary reversing chamber and returned again to the wheel. This process is repeated several times until practically all of the useful energy has been utilized.

r Full Details ask for Bulletin S-116

T-1154

TERRY SQUARE - HARTFORD, CONN.

Dependable Power that

Cooper-Bessemer Diesels
serve industry in these ways:

1. Produce power where electric energy cannot be bought economically.
2. Direct-drive high speed pumps.
3. Operate air and gas compressors.
4. Supplement steam plant equipment, where power load is greater than can be economically produced by steam needed for heating or processing requirements.
5. As standby for hydraulic turbines and water wheels in times of low water.
6. Produce electric power on construction work, where semi-portability is desirable.
7. Produce electric power in isolated locations, as at mines and quarries.
8. As standby for central station power.

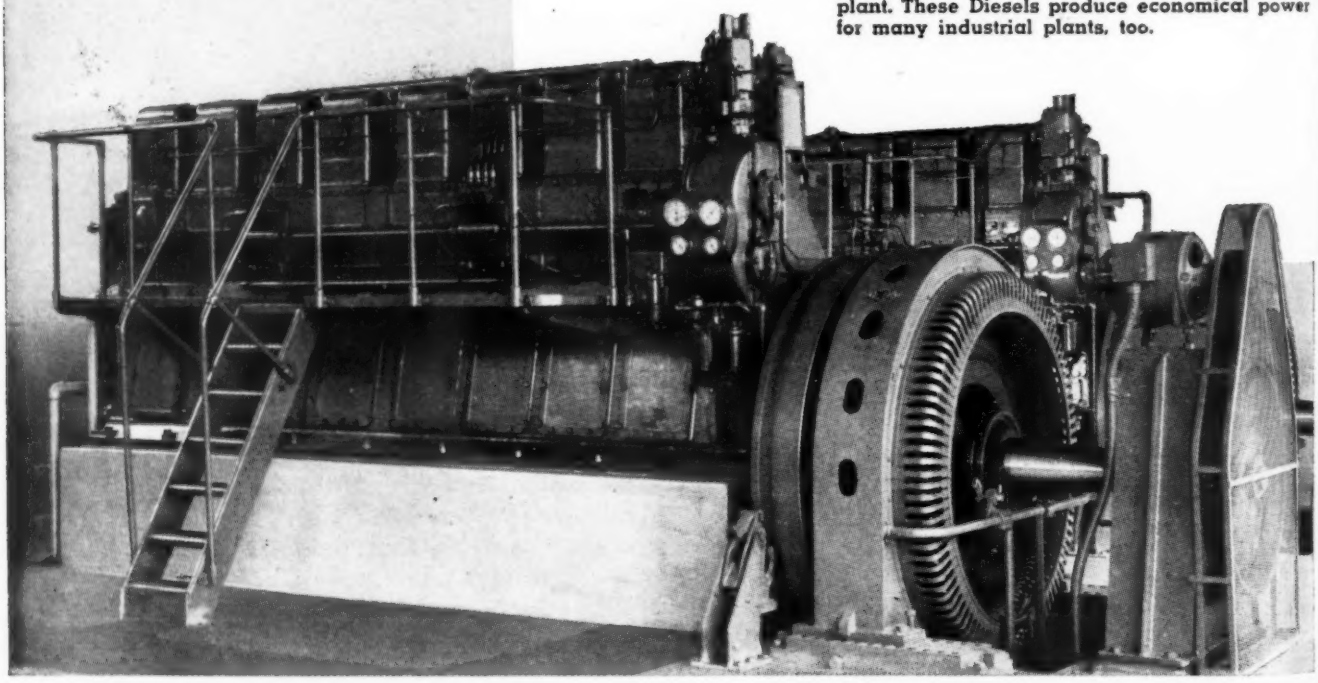
Ask any user of a Cooper-Bessemer why he likes it. Nine chances in ten, he'll mention Dependability—its ability to stay on the job year after year, handling overloads or normal loads without interruption of service, with negligible maintenance or repair.

Such dependable performance means Economy measured in low-cost operation . . . economy further emphasized by fuel saving and efficient work output, resulting from good design, advanced engineering and sound workmanship.

Most Cooper-Bessemer Diesels built since Pearl Harbor have gone into ships for the Navy and Maritime Commission. The hundreds of compressors have gone to such vital war industries as synthetic rubber, aviation gasoline, natural gas transmission, ammonia and helium production and other critical processing operations.

Of course, before the war, Cooper-Bessemer sup-

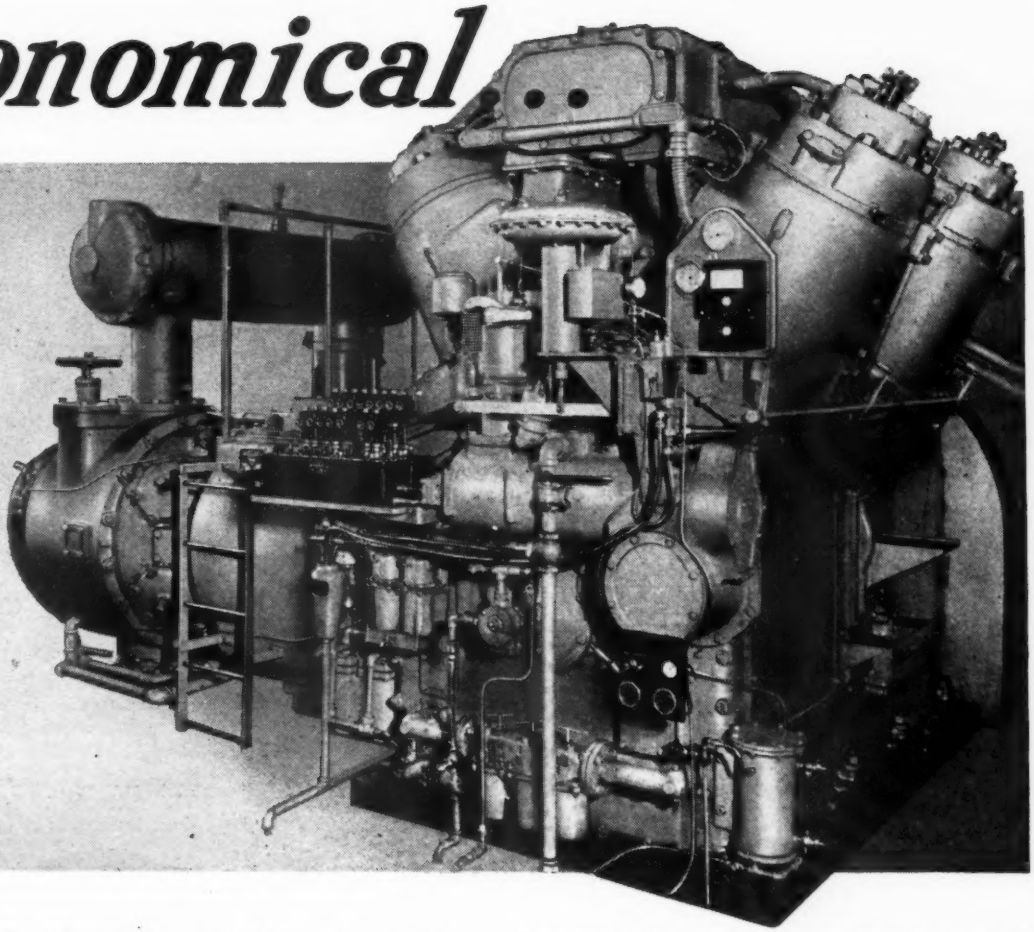
Two JS 8-cylinder Diesels, rated 688 hp. each, driving 493 kw. generators in a municipal plant. These Diesels produce economical power for many industrial plants, too.



DIESEL AND GAS ENGINES

FOR COMPRESSORS, PUMPS, GENERATORS

is *Economical* . .



This is one of 9 Cooper-Bessemer air-compressor units installed at the Chester, Pa., plant of Sun Shipbuilding and Dry Dock Co. The engines are V-type G-MV Diesels.

plied other hundreds of engines and compressors to industry . . . equipment that continues to perform dependably and economically today, under the heavier loads and trying conditions of wartime, often operated by personnel of little or no experience.

As war demands slacken, we are ready to build even better engines and compressors for industry . . . for our old customers and new ones, too, who want to enjoy the sure advantages of dependable, economical Diesel and gas engines to run generators, pumps, compressors, and other heavy equipment.

It is time now to figure your needs, immediate and post-war. Your inquiry will receive our prompt attention.

Diesel and Gas Engines For Compressors, Pumps, Generators

Type G-MV . . . *Industry's Most Efficient Compressor*

1. Do you supply compressed air in large volume?
2. Must it be available at dependably uniform pressure?
3. Do you want to produce it at lowest cost?

If your answer is Yes, then you'll be interested in the Cooper-Bessemer Type G-MV Air Compressor.

Type G-MV has proved itself in service to be industry's most efficient compressor, because of such unique features as its V-angle design, its use of full pressure lubrication, its sound principle of high-pressure fuel injection and low-pressure air scavenging, and its rugged construction of tough Meehanite metal throughout. It is supplied for either gas or diesel fuel, is easily convertible.

by **Cooper-Bessemer**

MOUNT VERNON, OHIO and GROVE CITY, PENNA.

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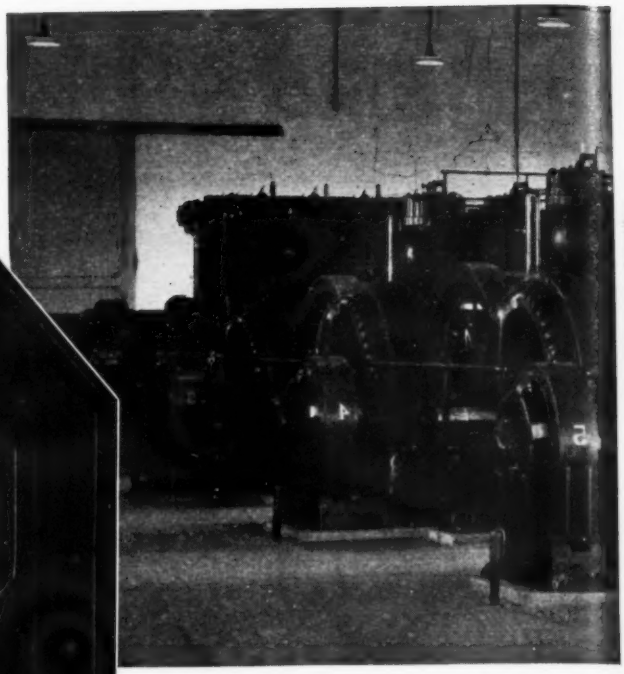
Houston, Dallas, Greggton, Pampa and Odessa, Texas Tulsa Shreveport St. Louis Los Angeles

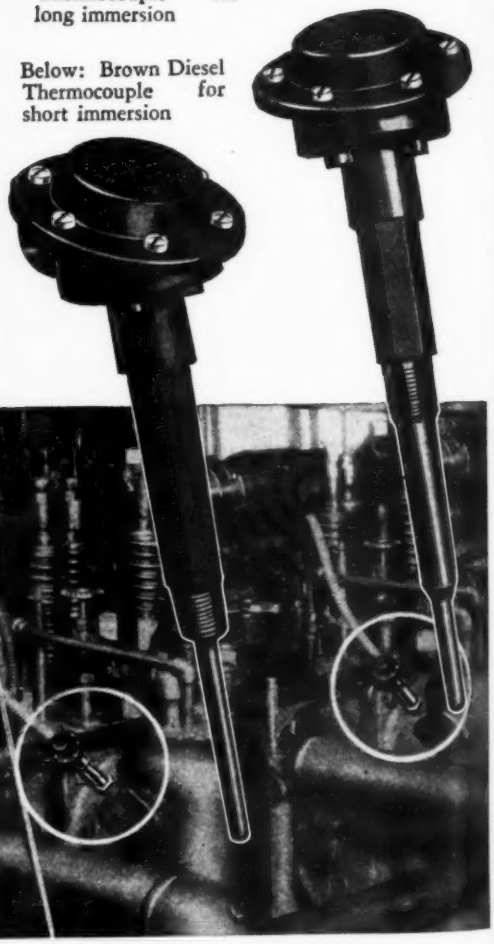
Exhaust temperatures of four Fairbanks Morse Diesels are accurately measured by Brown Pyrometers.



The Brown Pyrometer is easily installed for any Diesel Engine service. Switch dial supplied for 6, 12 or 24 points.

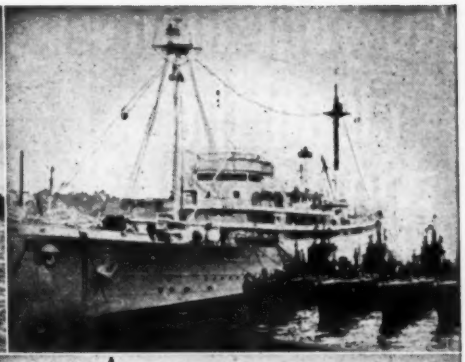
Right: Brown Diesel Thermocouple for long immersion

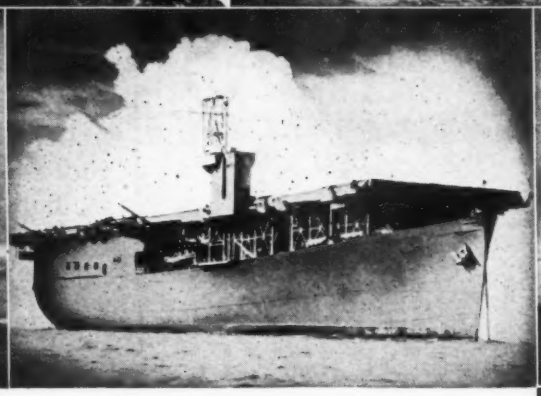
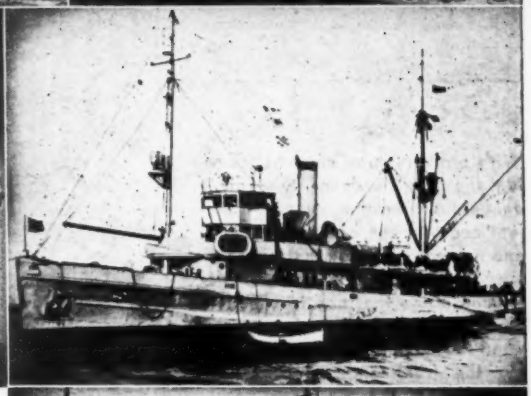
Below: Brown Diesel Thermocouple for short immersion



Brown Thermocouples in Cylinder Exhaust Headers of a 6 cylinder Diesel Engine.

BROWN DIESEL



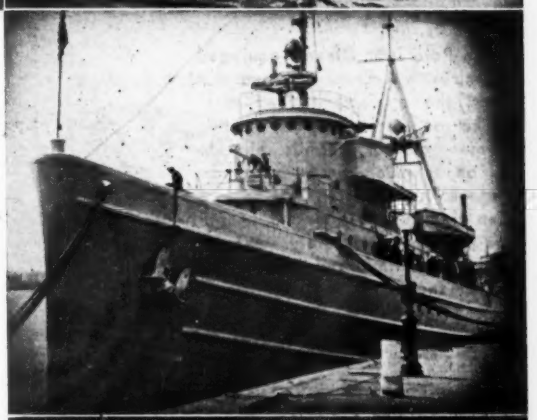
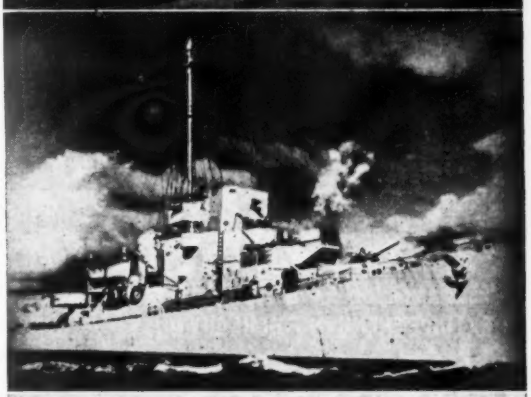
Check Exhaust Temperatures *for* DIESEL ENGINE EFFICIENCY

In the operation of Diesel Engines, it is essential that the load be distributed uniformly, otherwise it is evident that one or more cylinders must carry an overload. Serious damage to the engine may result when the load is unbalanced. It has been proved by extensive tests that the exhaust gas temperatures are the accurate guide in determining even load distribution on all cylinders.

"Maximum efficiency" under all loads might well be the watchword of Diesel Engines equipped with Brown Pyrometers. A click of a switch—a glance at the clear open dial—and the operator can quickly compare the temperature of each cylinder that insures maximum operating efficiency.

Wherever Diesel Engines are used—in industry—in transportation and on the sea, Brown Pyrometers have earned the preference of exacting engineers and the leading builders of Diesel Engines, because of their accuracy, simplicity, ruggedness and dependability. The saving in fuel alone has repaid the investment for Brown Pyrometers in many cases.

For information, write the Brown Instrument Company, 4490 Wayne Avenue, Philadelphia, Pa. Offices in all principal cities. 119 Peter Street, Toronto, Canada—Wadsworth Road, Perivale, Middlesex, England—Nybrokajen 7, Stockholm, Sweden.

ENGINE PYROMETER

Do your men clean the FRONT ends of tubes?

With ordinary tube cleaners, cleaning the front ends of tubes is a dangerous operation, even with perfect coordination between operator and helper. There is a natural tendency to insert the cleaner far enough inside the tube to eliminate any danger from revolving cutters when the air is turned on, thus leaving the front ends of tubes uncleaned.

With a Roto Tube Cleaner equipped with air valve directly behind the motor, the operator himself turns the air on and off. This positive one-man control permits him to turn on as much air as he needs, whenever he needs it, and he can clean right up to the end of the tube with complete safety. Get details of these time- and labor-saving tube cleaners.

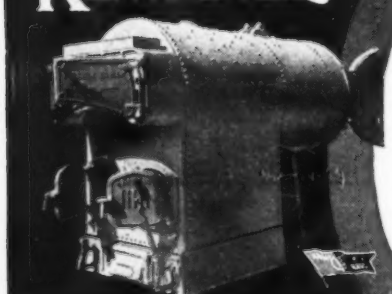
ROTO Tube Cleaners

The ROTO Company 145 Sussex Ave., Newark 1, N. J.

A Division of the Elliott Company

EXTRA STRENGTH FOR HEAVY DUTY

KEWANEE



KEWANEE BOILER CORPORATION
KEWANEE ILLINOIS

Steel Plus Rivets

Steel plus Rivets further strengthened by extra stout stays and braces. Embodies all characteristics which make firebox type boilers especially adapted for high pressure.... 4 to 304 H. P. 100, 125, 150 lbs. W. P.

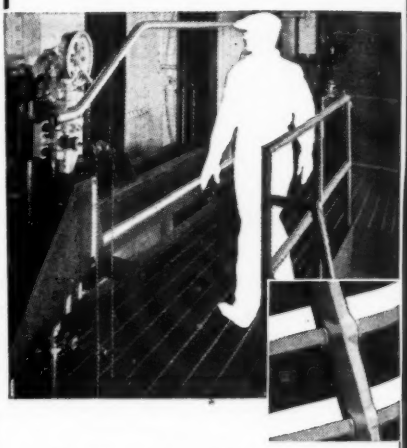
75 Years Boilermakers

Write Department 96-K-6 for 6" scale with pipe diameter marking.

BATES • GRATES
for Needed Construction

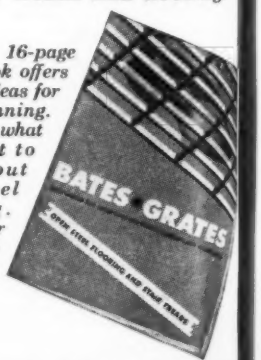
Priorities allow the use of steel for **BATES • GRATES.** Check now... send **BATES** your specifications. Your request will receive immediate attention.

BATES MEANS STRONGER, SAFER STEEL TREADS AND FLOORING FOR YOU

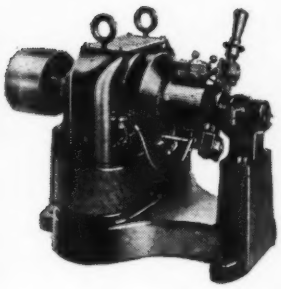


The patented fillet weld on the Hex cross bars of **BATES • GRATES** gives you a combination of maximum strength and floor safety ... PLUS easier maintenance. That's why it's so much more worthwhile to specify **BATES • GRATES** for your open steel stair treads and flooring.

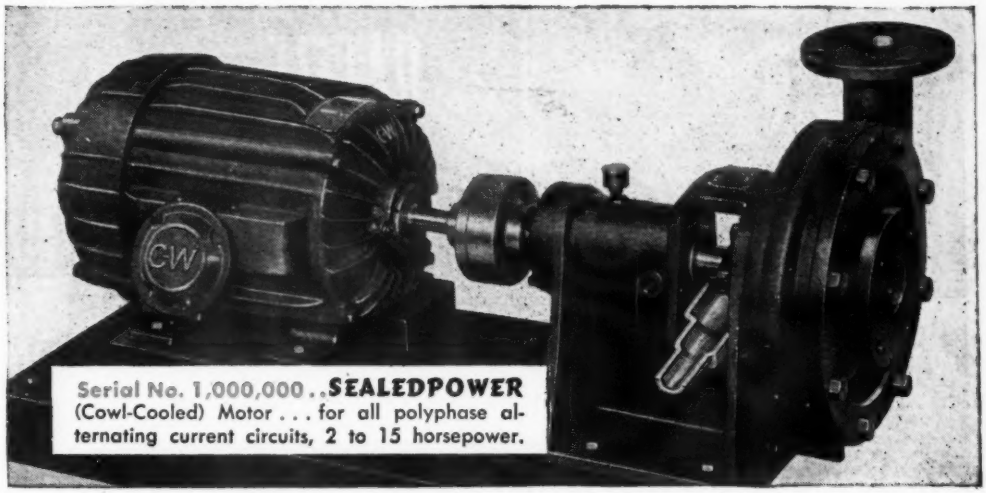
The new 16-page **BATES** *Book offers you new ideas for plant planning. It tells you what you want to know about open steel flooring. Write for your copy today.*



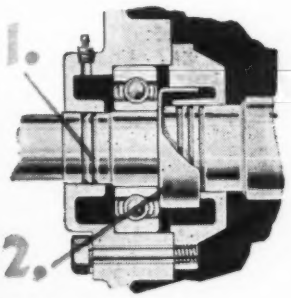
WALTER BATES COMPANY, INC.
JOLIET • ILLINOIS
OPEN STEEL FLOORING • STAIR TREADS



Serial No. 1 . . . Crocker-Wheeler Motor, built in 1888.



Serial No. 1,000,000 . . **SEALEDPOWER** (Cowl-Cooled) Motor . . . for all polyphase alternating current circuits, 2 to 15 horsepower.



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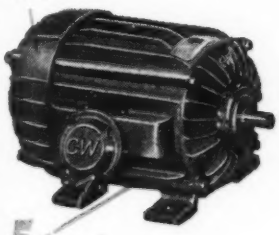

5.

SEALEDPOWER

Industry's Most Trouble-Free Motor

PRODUCED BY CROCKER-WHEELER'S 56 YEARS OF EXPERIENCE

CROCKER-WHEELER FEATURES:

1. Patented "Groovseal"—no greasing needed for at least a year. Grooves minimize grease loss. This seal makes bearing maintenance expense negligible. It permits use of softer grease, for better lubrication and longer bearing life. Airtight seal prevents dust or other foreign matter from entering bearings.

2. Crocker-Wheeler's exclusive De-Sludging Impeller. Automatically desludges . . . churns and distributes grease to bearings when motor is started.

3. Vacuum Impregnation—standard on *all* Crocker-Wheeler motors. Seals out foreign matter and moisture from each individual coil . . . fills all interstices, making windings a homogeneous mass . . . reduces hot-spot temperature and lengthens insulation life. Adherence of varnish prevents vibration of wires either inside or outside of slot. (Photograph shows cross sections of baseballs, (left) after vacuum impregnation and (right) before vacuum impregnation. Note penetration of varnish to center of tightly-wound ball, making it a moisture-proof, homogeneous mass.)

SEALEDPOWER FEATURES:

4. Totally Enclosed Cowl-Cooled Construction resists corrosion. Protects against acid or alkali fumes, splashing or dripping liquids, air-borne moisture, steam, corrosive gases, conducting dusts, metallic chips, etc.

5. Fin Type Construction for non-clog ventilation and easy cleaning.

WRITE FOR LITERATURE ON THE **SEALEDPOWER** MOTOR, WHICH IS WINNING THE PREFERENCE OF MACHINERY MANUFACTURERS AS WELL AS OF MOTOR USERS. OR CALL OUR NEAREST OFFICE.

CROCKER-WHEELER Motors · Generators

JOSHUA HENDY IRON WORKS

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ESTABLISHED 1856

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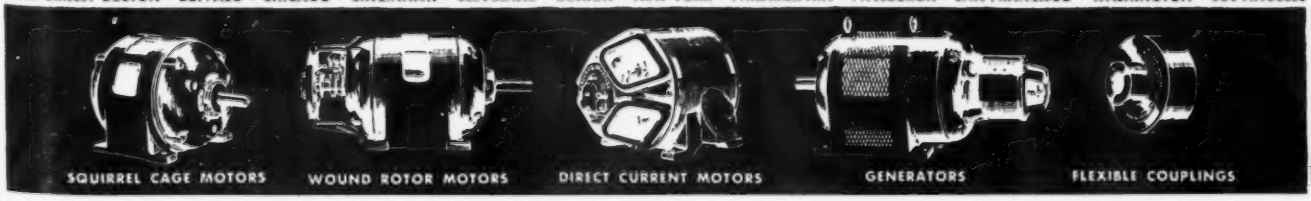

SQUIRREL CAGE MOTORS | WOUND ROTOR MOTORS | DIRECT CURRENT MOTORS | GENERATORS | FLEXIBLE COUPLINGS

PATCH FLOORS

. . . . Truck Over Immediately

Here's a new, fast way to patch broken concrete without having to close off the area. Use durable INSTANT-USE . . . a tough, plastic material which you simply shovel into hole—tamp—and run traffic over immediately. NO WAITING. Bonds tight to old concrete. Makes smooth, solid, heavy-duty patch. Withstands extreme loads. Keep a drum on hand for emergencies. Immediate shipment.

Request Descriptive Folder . . . and Details of
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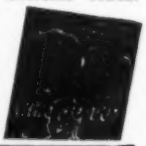

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FLEXROCK Co.
3677 Filbert St., Philadelphia 4, Pa.

Please send me complete INSTANT-USE information . . . details of FREE TRIAL OFFER —no obligation.

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Company .....
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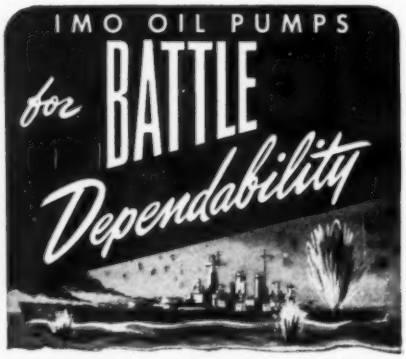
IMO OIL PUMPS

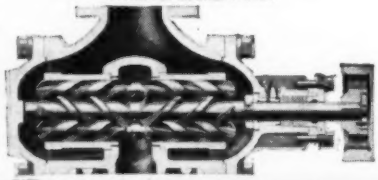
for BATTLE Dependability



A cruiser of the U. S. Navy, one of the classes of ships equipped with De Laval-IMO oil pumps

On fighting ships, where reliability and dependability under strain are all important and where space is at a premium, many thousand IMO oil pumps are in use pumping fuel oil, circulating lubricating oils, and operating hydraulic machinery. The simplicity of construction and operation that makes the IMO pump so dependable in battle assures the commercial user of long life and trouble-free operation. This unique pump has practically nothing to get out of order; it has only three moving parts, and no pilot gears or valves.

Write for Leaflet I-117.



IMO PUMP DIVISION
of the De Laval Steam Turbine Company
Trenton 2, New Jersey

A FAMILIAR CONTROL

Mercoid has served the nation's peacetime control requirements for more than two decades. During these years, experience has demonstrated the correctness of the design and operation of Mercoid Controls. Their record of accurate and dependable performance is the basis for their wide acceptance among engineers planning America's essential wartime production.

The "familiar" DA type control shown above, is a favorite with industry. The outside double adjustment feature and direct reading simplifies the setting and eliminates all guesswork, an important factor considering new help in all plants.

All Mercoid Controls are equipped exclusively with hermetically sealed corrosion-proof mercury switches, thus assuring positive operation and longer control life.

If you have a control problem involving the automatic control of pressure, temperature, liquid level, mechanical operations, etc., it will pay you to consult Mercoid's engineering staff—always at your service.

Write for Mercoid Catalog No. 600. It contains a lot of control information

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CONTROLS AND MERCURY SWITCHES

XZIT

FIRE-SCALE AND SOOT ERADICATOR

Eliminates Soot and Fire-scale without chipping or scraping

Manual chipping of fire-scale and scraping soot from boiler heating surfaces wastes valuable time and labor, and ties up the unit.

Simply feed Xzit into the fire-box while your boilers continue to operate, and all accumulated fire-scale and soot will be reduced chemically so they can be dissipated by natural draft or blowing, without chipping or scraping.

Xzit stops sparking and extinguishes stack fires instantly. Periodic use keeps heating surfaces clean, saving fuel and reducing maintenance.

Xzit is being used in all types of stationary power plants and on board American and Allied merchant and naval vessels.

Write for demonstration in your plant.

XZIT SALES CO.
1031 Clinton St., Hoboken, N. J.

KEROTEST

War Weapons Now

Equally Important for Dependable Control of

YOUR

PEACETIME EQUIPMENT

When the white flag of *unconditional surrender* is unfurled by the enemies of civilization—another important chapter in the brilliant, twenty-five year history of Kerotest will have been written.

Called upon by America and her fighting allies to contribute practically their entire production resources and facilities to valves for vital war requirements,—KEROTEST engineers began a 24-hour, round-the-clock offensive—to improve a product that had already set a high standard of quality and dependability in valve control wherever installed.

The results of this unceasing research into new materials, new alloys, faster production methods to provide greater dependability and better performance for the needs of WAR, will prove invaluable in your peacetime equipment.

KEROTEST MANUFACTURING COMPANY

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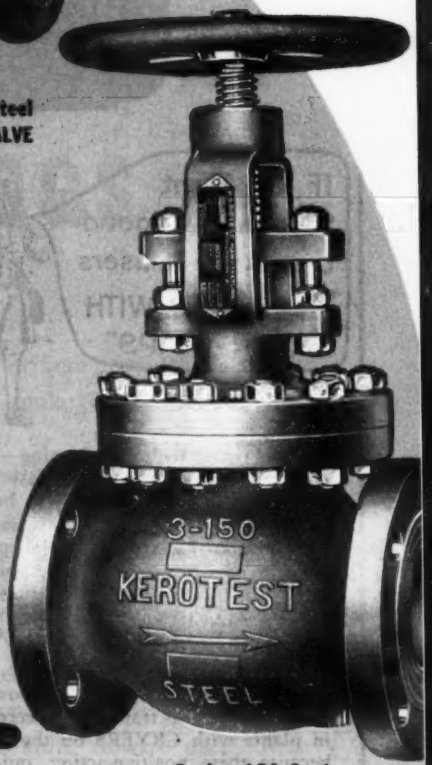
Series 150 Cast Steel Flanged GATE VALVE



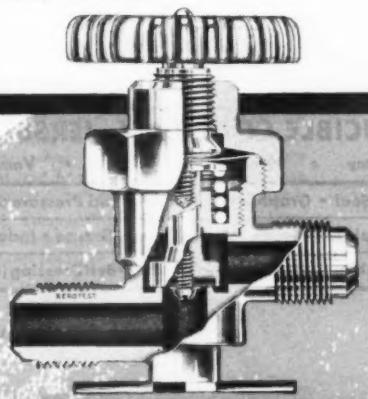
Series 150 Cast Steel Flanged End GLOBE VALVE

Series 150 Cast Steel Flanged End ANGLE VALVE

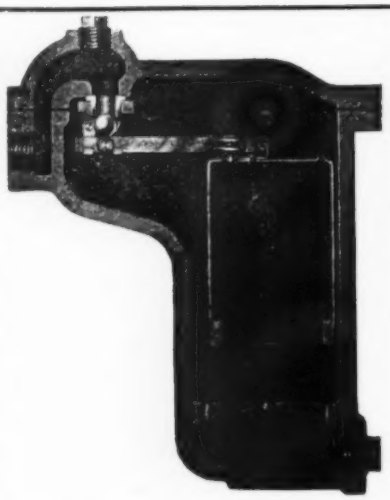
Dependable

KEROTEST

Valves



Patented KEROTEST Brass Diaphragm Packless Valves



IF You Want to know how good they are - ask users "ALL'S WELL WITH CRYER TRAPS"

Five years without cleaning—no sticking—no replacements—easy to hook up—easy to get at—less bulk for comparable capacity—100% satisfaction from traps that "really operate"—these are a few of the typical reports you'll get from users, if you ask them (as we did) about their experience with CRYER STEAM TRAPS.

There's actually no man-power problem as far as traps are concerned in plants with CRYERS on the job, because these positive-acting, quick-venting, non-binding traps require so little attention. And when cleaning *is* necessary, it's a matter of only minutes to open them up and get at the entire, easily accessible mechanism for a quick, thorough cleaning.

Sizes ½" to 2¼".
Capacities: 500 to 38,000 lbs. of water at pressures from 0 to 250 lbs.

We carry all sizes of traps and repair parts for the line formerly known as the J-M Ball Steam Trap.

Ask us for further details—Investigate NOW!

CRYER TRAP & VALVE CO.
366 Madison Ave., New York, N. Y.
Manufacturers of Steam Specialties for over 40 years.

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Kindly send me full details on CRYER BUCKET TYPE STEAM TRAPS

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FOR freedom from leaks IN PIPE JOINTS

Here are two heat-proof, corrosion-proof graphite products which make the benefits of Dixon's 117-year "Know-how" available to engineers and maintenance men seeking permanent leak-proof connections.

DIXON'S PIPE JOINT GRAPHITE COMPOUND

For pipe lines carrying steam, water, air, gas, acid and brine. Acts as a lubricant and leak proof seal for threads on pipe joints and on gaskets, bolts, nuts, turn-buckles, etc. Joints thus made up never rust fast, and may be taken apart without difficulty, even years later.

DIXON'S GRAPHITE SEAL

For pipe lines carrying hot or cold oils, gasoline, benzine, naphtha, kerosene, etc. A graphite paste unequalled for sealing screw thread, flange and gasket joints.

- Makes them leakless while assuring quick easy assembly and dis-assembly at all times without damage to fittings.

At your usual supply house, or write for printed No. 94.

JOSEPH DIXON CRUCIBLE COMPANY, JERSEY CITY 3, N. J.

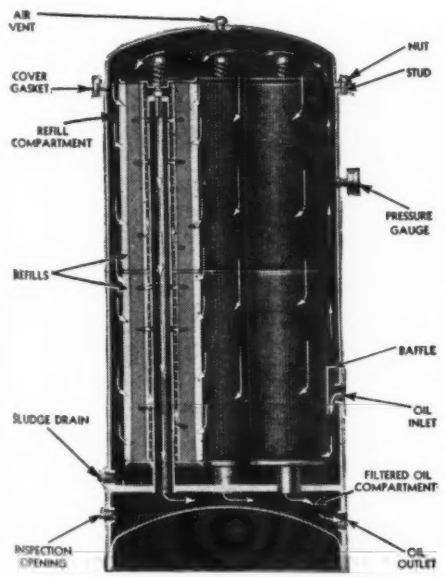
Canada: Canadian Asbestos Company • Montreal • Toronto • Vancouver • Winnipeg

Pipe Joint Compound • Graphite Seal • Graphited Oils • Cup and Pressure Gun Grease • Slip-stik
Gear Lubricants • Waterproof Graphited Grease • Auto-Marine Grease • Industrial Oven Lubricant
Graph-Air Guns • Lathe Center Graphite Lubricant • Welding Rods • Belt Dressing (Contains no Graphite)

New! An Improved FUEL OIL FILTER by BRIGGS

The improved DFR Series Briggs Fuel Oil Clarifier. Note the two gauges that enable the operator to observe at a glance the pressure differential across the filter.

Outer case and cover are of heavy gauge welded steel . . . hydrostatically tested to pressures well above working pressures encountered under operation. Compact design requires minimum floor space. Simple to install and service.



Follow the oil through the Briggs Fuel Oil Clarifier. See how it first passes through the cellulose (A) where solid impurities are ABsorbed, next—through the Briggs Patented Moulded Fullers Earth Block (B) where the invisible contaminants . . . gums, corrosive acids, resins . . . are removed by ADsorption and finally—again through cellulose (C) where even the minutest foreign particles are removed.

Improved refill holding assembly assures a perfect seal at ends of refills at all times—eliminates possibility of by-passing—provides uniform pressure over entire end of refill.

This new line of Briggs Fuel Oil Clarifiers provides a proved-efficient unit for every size and make Diesel engine . . . with flow capacities ranging up to 500 G.P.H. Every requirement for maximum efficiency has been anticipated by Briggs engineers . . . every possible feature has been incorporated in order to give your Diesel engine 100% protection against the hazards associated with unavoidably contaminated fuel oil.

Fuel lines will remain clean and unobstructed. The injector system will function more efficiently under this protection. You'll have fewer shut downs and lower operating costs.

Investigate these improved Briggs Fuel Oil Clarifiers. Learn why they are investments that pay for themselves in actual money saved. Complete specifications of all models on request. Custom-built models available for special applications. See the Briggs representative in your locality.

Briggs
PIONEERS IN MODERN OIL FILTRATION

BRIGGS CLARIFIER COMPANY

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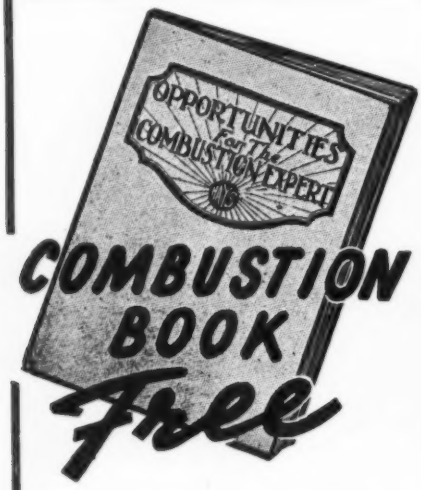
REPRESENTATIVES IN PRINCIPAL CITIES



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Combustion efficiency as applied to Boiler Plant Operation, Fuels and Equipment is now a most important factor in Defense work. Fuels cost more than ever before. Boiler loads are heavier. A scarcity of some kinds of fuel is apparent.

The Combustion trained man—the Hays trained man—can do his part, and open up big opportunities for himself that never existed before, by devoting a little of his spare time in training himself to meet present conditions.

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Armour and Co.	75
Combustion Engineering Company	45
Riley Stoker Corp.	75
Iron Fireman Mfg. Co.	35
Commonwealth Edison Company	145
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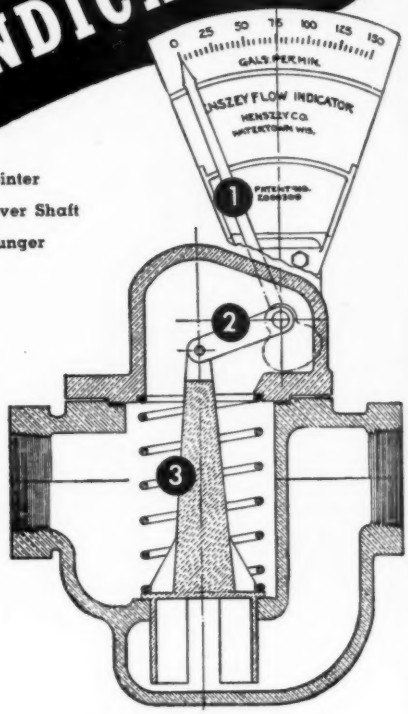
Only 3 MOVING PARTS in the HENSZEY FLOW INDICATOR



1. Pointer
2. Lever Shaft
3. Plunger

And that means longer wear, continued service, and constant accuracy.

The Henszey Flow Indicator has found wide use in many war industries where the accurate knowledge of the rate of flow of a liquid is a necessity.

The liquid enters the indicator below the plunger forcing the plunger upward. Slots in the side of the plunger allow the liquid to pass. Increased flow will increase the lift, exposing a greater area of the slots so that the lift of the plunger is in proportion to the rate of flow of the water.

Henszey Indicators accurately register the flow from zero to 100%. The graduations on the dial are uniformly spaced from one end to another and read direct. The entire instrument can be installed right in the pipe line.

Consider Henszey Flow Indicators for your "tough problem". Installations are satisfactorily performing in nationally known paper mills, chemical plants, petroleum refineries, milk condenseries and other war industries.

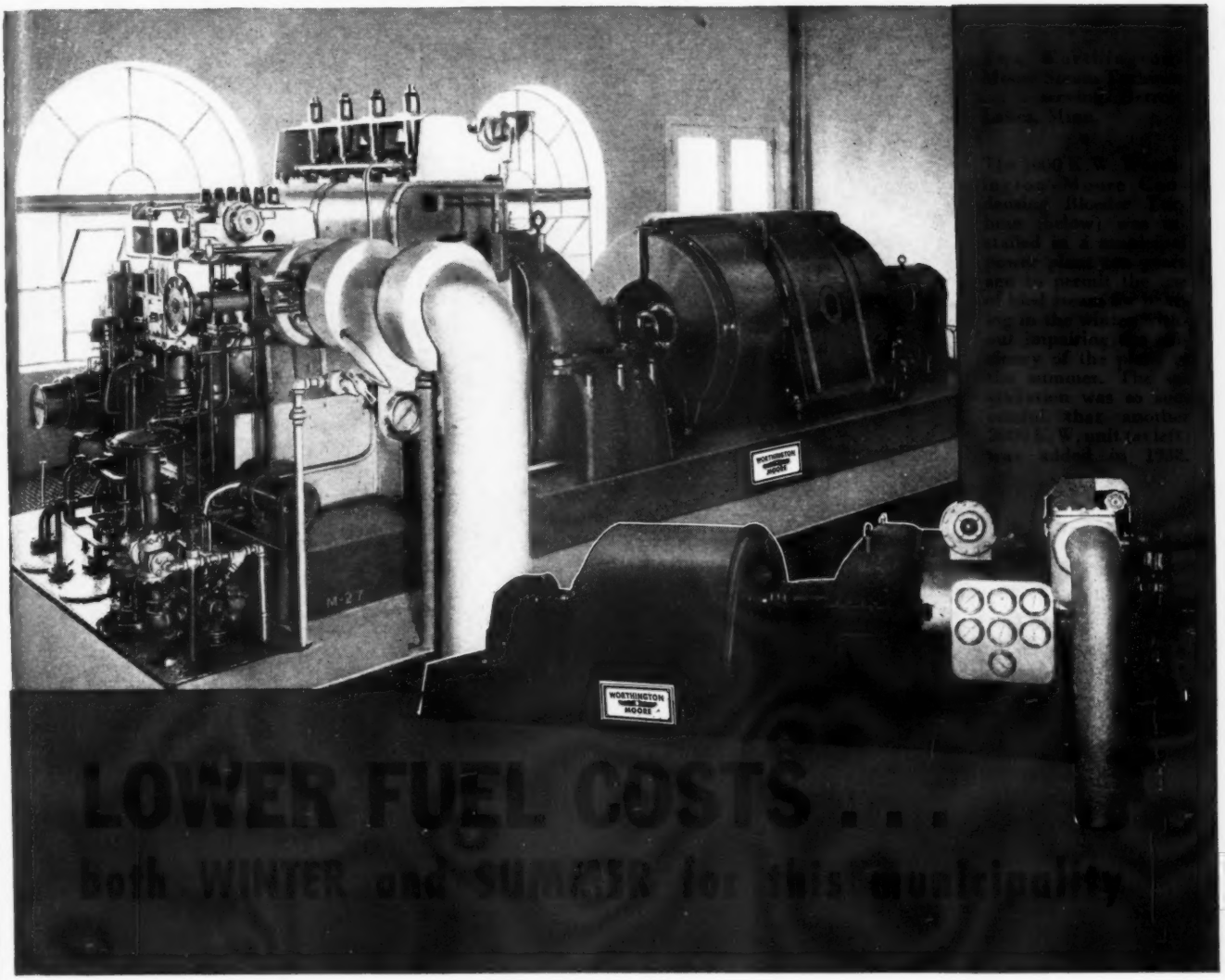
Send for Bulletin FI-1

HENSZEY CO., Dept. D-6, Watertown, Wis.

HENSZEY

FLOW INDICATORS

Continuous Blowdown • Distillation Systems • Heat Exchangers
Feed Water Meters • Boiler Feed Regulators • Proportioning Valves



When electrical and heating requirements vary widely at different periods or seasons, there is bound to be an excess of fuel consumed unless there is suitable provision on the installation for balancing the heat and electrical loads. Worthington-Moore Condensing Bleeder Turbine Generator Units are ideal for such conditions.

The two units illustrated above operate with steam at 350 lb. gauge-pressure, 635° F. total temperature, exhaust to 28″ vacuum and extract steam at 10 lb. gauge pressure for heating. Both of these units give efficient operation straight condensing during the summer months and provide bled steam for municipal heating purposes during the winter.

Moore Engineers will be glad to study your electrical and heating requirements and give you an estimate of the fuel savings possible with a Worthington-Moore Unit.

MR4-2

BEHIND THE NAME
WORTHINGTON
MOORE

WORTHINGTON PUMP AND MACHINERY CORPORATION, HARRISON, NEW JERSEY • MOORE STEAM TURBINE DIVISION, WELLSVILLE, NEW YORK

PRODUCTS OF WORTHINGTON

AIR CONDITIONING EQUIPMENT • REFRIGERATION AND ICE PLANT EQUIPMENT • AIR AND GAS COMPRESSORS • STEAM TURBINES • DIESEL ENGINES • GAS ENGINES • CONVERTIBLE GAS-DIESEL ENGINES • CENTRIFUGAL HIGH-PRESSURE BOILER FEED PUMPS • DIRECT-ACTING STEAM PUMPS • POWER AND ROTARY PUMPS • TURBINE WELL, SUMP AND DRAINAGE PUMPS • STEAM CONDENSERS AND AUXILIARIES • VACUUM PUMPS • STEAM JET EJECTORS • WATER PURIFICATION EQUIPMENT • PORTABLE COMPRESSORS AND AIR TOOLS

SMOOTH-ON REPAIR RECORDS

Cracked Heater Shell

The crack was long and apparently hopeless. However, the shell was saved by tamping a putty of SMOOTH-ON No. 1 into the crack by means of a hammer. The repair was then reinforced with a patch plate which was held in place by machine screws.

Reinforcing patch plates for SMOOTH-ON repairs need not be in one piece, and frequently narrow straps or bands will serve the purpose.

FOLLOW THIS SERIES OF SMOOTH-ON SAVINGS

The unique expanding property of SMOOTH-ON No. 1 causes it to wedge itself tightly between the confining surfaces of a crack. This is why SMOOTH-ON makes such a tight seal; and as it hardens like iron, the SMOOTH-ON also makes a durable repair.

For half a century, SMOOTH-ON has been demonstrating these qualities which have made it a necessity in every plant for stopping leaks, sealing cracks, and tightening loose parts of apparatus, pipe lines and structures. By keeping a can on hand, you will be prepared for many routine maintenance jobs and emergency repairs.

Buy SMOOTH-ON No. 1 in 7-oz., 1-lb., or larger containers from your supply house, or if necessary, from us. For your protection, insist on SMOOTH-ON, used by engineers and repair men for over 45 years.

FREE

REPAIR HANDBOOK SHOWS HOW

40 Pages, 170 diagrams, and simple concise instructions for practical repairs to plant equipment, pipe lines and structures. A necessity in every plant. Your copy sent FREE if you fill in and return the coupon.

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Please send SMOOTH-ON HANDBOOK

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Do it with **SMOOTH-ON**

Again Available

TO MEET MOST PRODUCTION SCHEDULES

At WESTON, production finally has outstripped the overwhelming war demand for panel and other instruments . . . making WESTONS again obtainable on a basis to meet most war production schedules.

To experienced instrument users, this means they again can obtain the instruments whose design and manufacture incorporate the broadest instrument experience in surmounting the requirements of exacting applications. The instruments whose consistent, uniform performance simplifies their problems of inspection, handling and other burdensome procedure . . . and whose dependable, long-term accuracy assures better operating performance from the devices into which they're built.

Why not discuss your instrument schedules with WESTON, today . . . and be sure of obtaining the added product efficiency which authentic WESTONS provide.

- *Panel & Switchboard Instruments (DC, AC, and Thermo)*
- *Precision DC and AC Portables*
- *Instrument Transformers*
- *Specialized Test equipment*
- *Laboratory Standards*
- *Sensitive Relays*
- *Light Measurement Instruments*
- *Aircraft Instruments*
- *Electric Tachometers*
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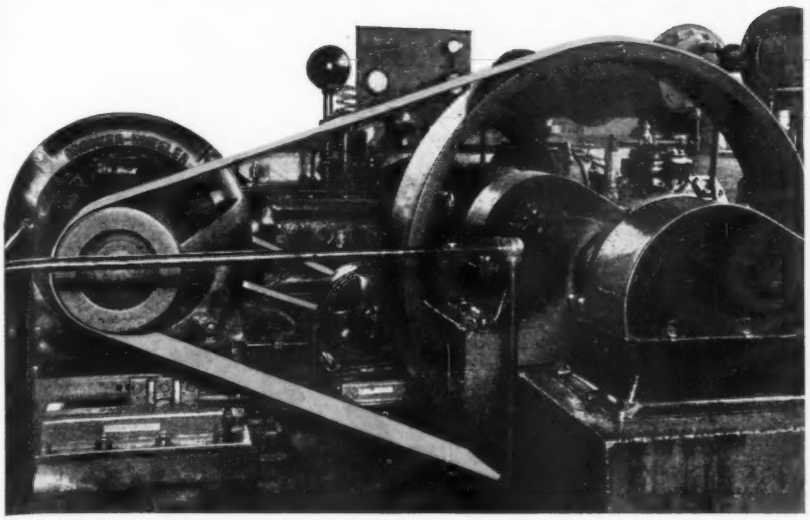
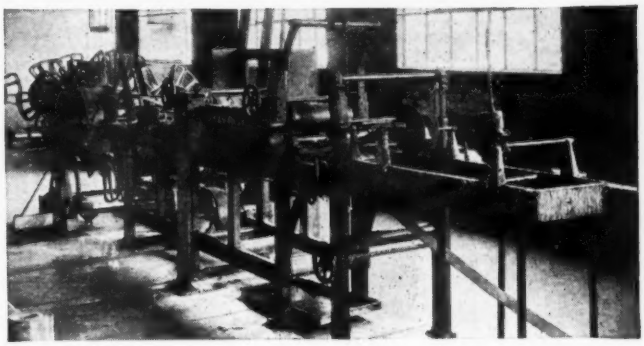


These drives, utilizing the advantages of pivoted bases and "Research" Leather Belting's *Double Plus,* are typical. Installed June, 1940, they have required no attention since. Near belt, 14" "Research" double, 25½' long, drives 72" compressor pulley from 17½" pulley on 100 KVA synchronous motor (900 RPM). 4" "Research" double, 10' 11" long, drives 7½" pulley on exciter from 12" motor pulley.

No substitute can equal THIS . . . for trouble-free performance

The material with the best *natural* power transmission properties is leather—due to its unique fibrous structure. The science of *chemistry* develops those properties to give leather belts (among other advantages) unusual resiliency, protecting against undue strain on belt or equipment. Thus, leather retains its power-transmitting ability longer.



The leather belt providing longest trouble-free service is Graton & Knight's "Research". Among several manufacturing advantages is *Tension-Cementing*—a G&K-patented development that provides mechanical perfection *not obtainable by any other means* in cementing plies. "Research" has the most uniformly high adhesive strength ever obtained in belting.

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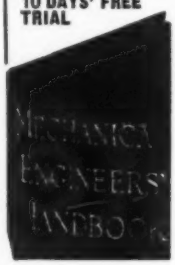

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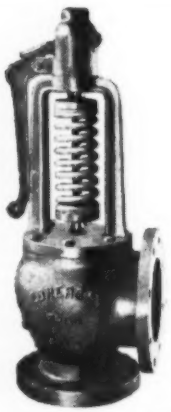

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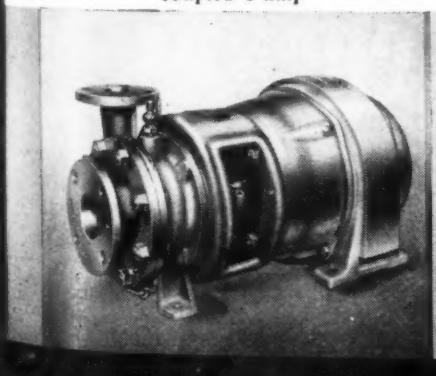

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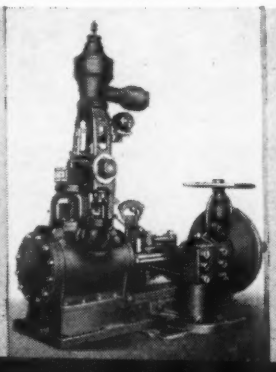

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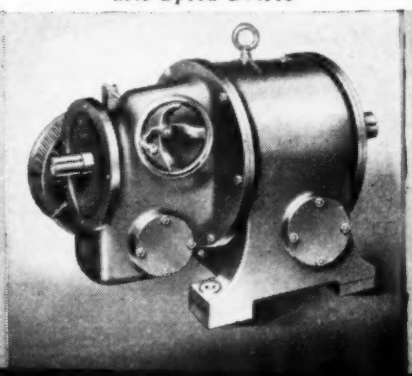

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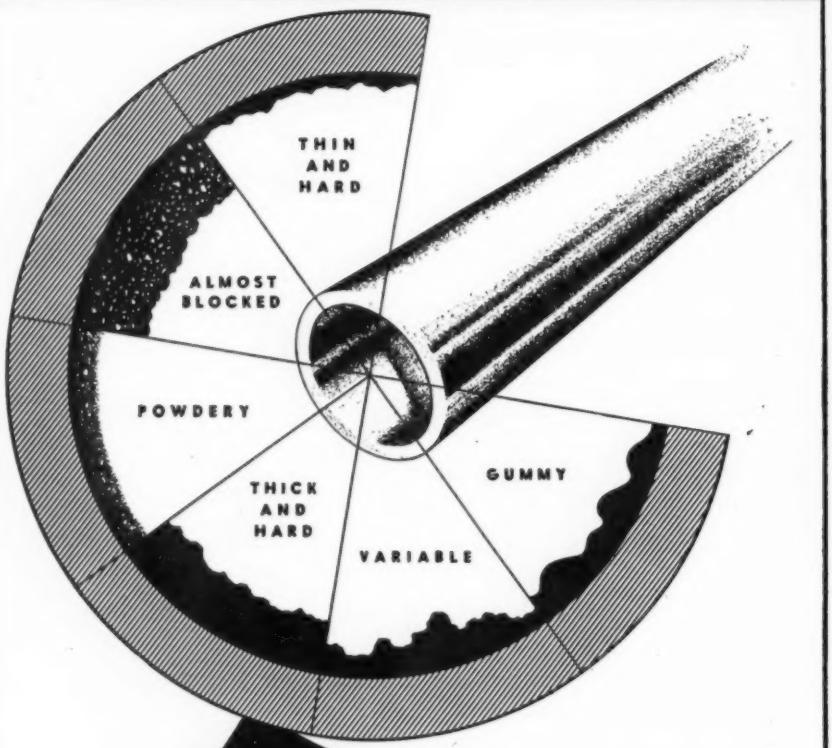

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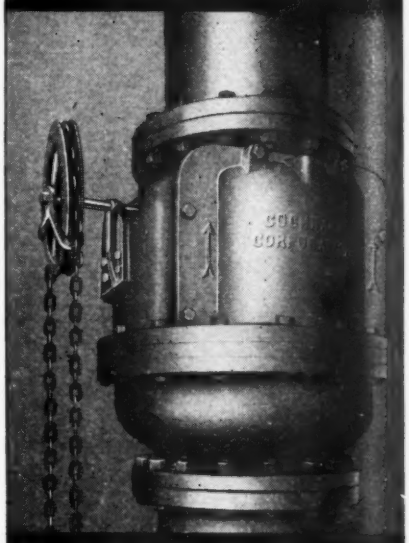

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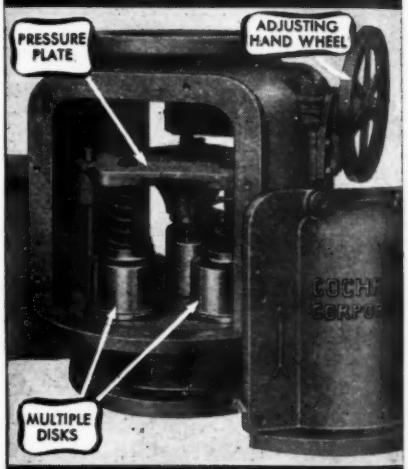

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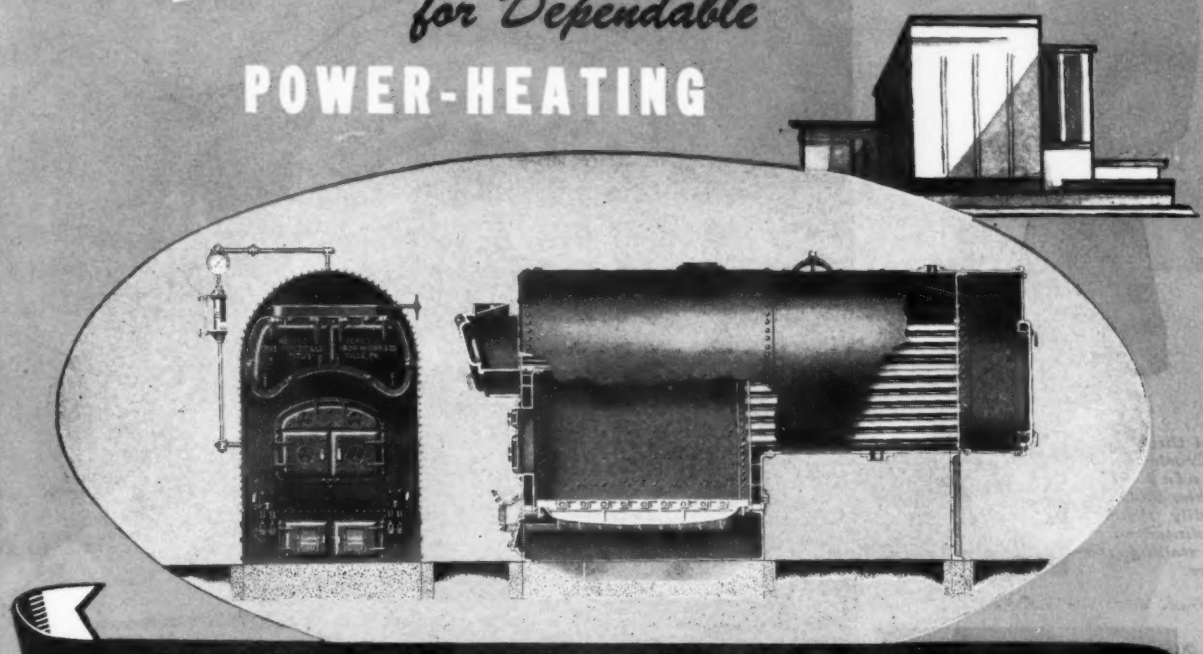

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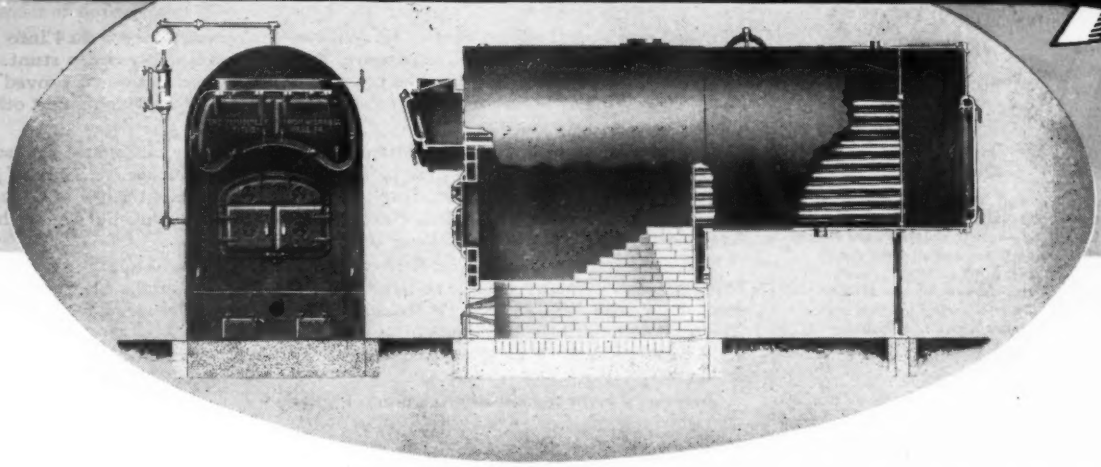

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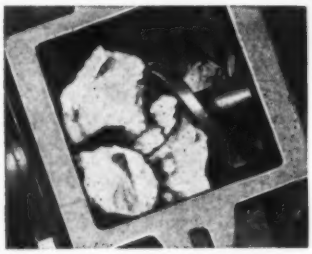
BUT A *POWER DEMONSTRATION* OF GENUINE IMPORTANCE TO EVERY BUYER OR SPECIFIER OF AUTOMATIC COAL BURNING EQUIPMENT

A 2x4 thrust into the Crusher Block opening of a Winkler Stoker is speedily reduced to splinters without stalling the stoker.



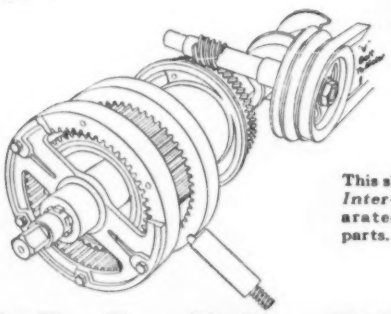
Slate, rocks and other obstructions sometimes find their way into the coal pile. Unless the stoker driving unit is powerful enough to smash and feed them to the fire, a breakdown results. The illustration above is an actual photograph of a rock being ground up against the Crusher Block of a Winkler Stoker.

Showing you how the Feed Screw of a Winkler Stoker will chew a 2x4 into matchwood, *or grind a rock into fragments*, is not a meaningless circus stunt. It is a demonstration of *extra power!* The practical value of extra power is proved by the fact that a Winkler Stoker *crushes* foreign matter in the coal which might otherwise cause a service interruption.

The reserve power in a Winkler Stoker comes from a fully automatic Transmission of exclusive and revolutionary design. Through an ingenious use of *internal planetary gearing*, the Transmission develops a continuous, smooth flow of tremendous energy. Internal gears have a larger arc of contact which means lighter tooth loads, less wear, higher efficiency and *long life!*

These are the reasons Winkler Stokers are immune to usual operating hazards. In the case of extreme overloads, as might be caused by a metallic obstruction in the feed screw, the Winkler Safety Release automatically disengages and re-sets the Transmission, until the blocking object is removed. Full protection is thus given the motor and stoker without need for a shear pin!

Your request for further information is invited.



This sketch shows the Winkler *Inter-plan* Transmission separated into its component parts.

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fully automatic **STOKERS**

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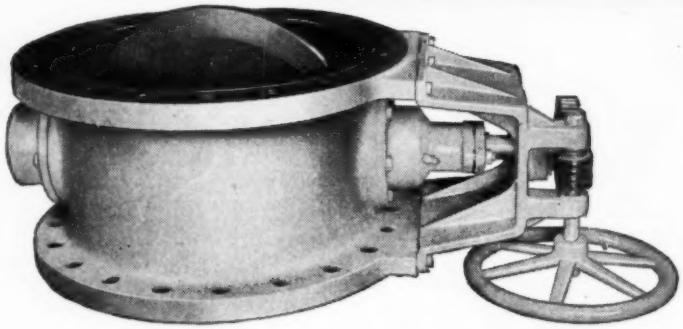
150-pound steel valve with raised face. Hand wheel operated. Extra rugged construction.



R-S Cast Steel Butterfly Valves are divided into two classes. Class A are lightweight, close coupled 15-pound valves with series 15 flanges. For limited pressure drops, ball bearings can be used. Class B are constructed for heavy duty service. The face-to-face dimension is greater than that of Class A valves, permitting the installation of oversized shafts, bearings, stuffing boxes, etc. for higher working pressures and temperatures.

In ordering any R-S Butterfly Valve, regardless of type, class or service for which it is to be used, it is essential to furnish the following information:

1. Size of valve and type of flanges.
2. Nature of gas, liquid or other material to be shut-off or controlled.
3. Line pressure and pressure loss in valve.
4. Rate of flow and operating temperature.
5. Method of control (hand lever, chain lever, hand wheel, chain wheel, extended shaft for inaccessible locations or power operation).

No. 610
Heavy-duty air motor operated steel valve equipped with hand jack, mercury switch, hand wheel declutching unit and dual stuffing box.

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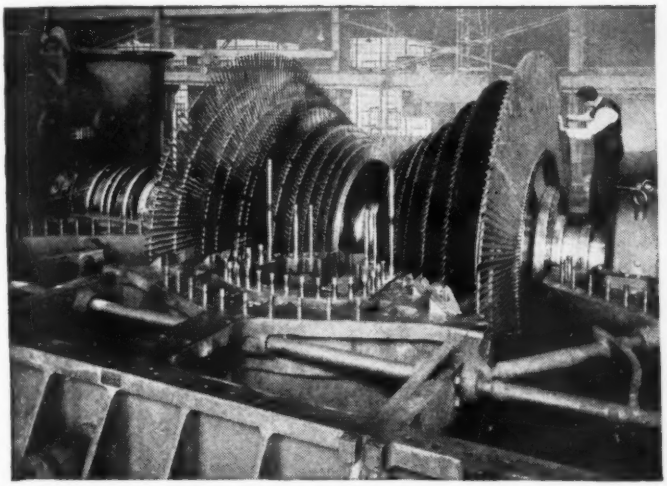
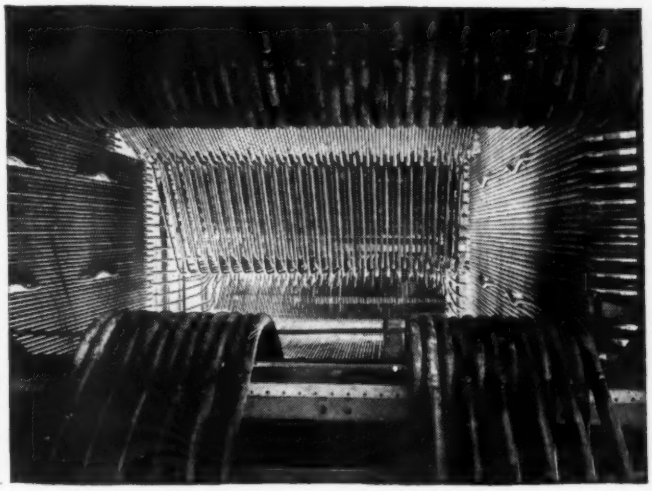
meet power plant requirements



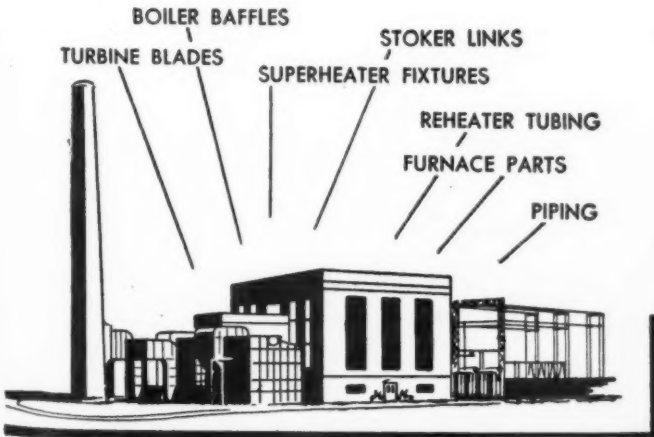
Turbine blades resist corrosion and erosion when made of stainless steel.



In this high-pressure, high-temperature boiler, connection superheater tubes are 4 to 6 per cent chromium.

● Chromium irons and steels for such parts as superheater tubes, steam pipes, turbines, furnace parts, and other power plant equipment help to give efficient, trouble-free performance. Steels containing from 4 to 6 per cent chromium and 0.5 per cent molybdenum, for instance, have good resistance to scaling and creep. The 18-8 chromium-nickel stainless steels have high strength and resistance to corrosion and oxidation. Higher chromium steels have good resistance to oxidation at high temperatures. Chromium cast irons resist wear and growth even when repeatedly heated and cooled. The illustrations show a few applications which may suggest where you can use chromium irons and steels to advantage.

We do not make iron or steel of any kind, but we have for over 37 years produced Electromet ferro-alloys used in making iron and steel. With the knowledge accumulated from this experience, we are in a position to give you impartial assistance in the selection of a chromium iron or steel to suit your particular needs.



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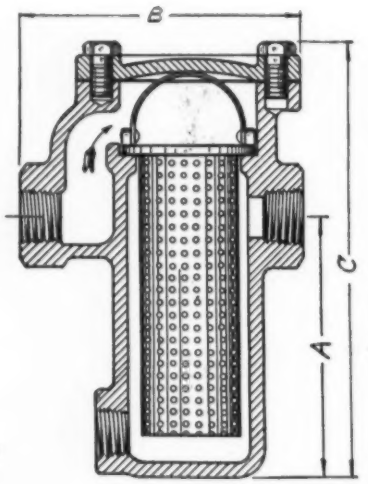

BASKET TYPE FOR VARIOUS FLUIDS

The EDCO basket type strainer is used extensively on suction and pressure pump lines carrying water, oil and other fluids.

The baskets are made from either brass or steel screens or perforated sheets, depending on the nature of the operation.

EDCO Strainers are easily removed for cleaning by the handle attached to the basket. The body and cap are cast bronze but can be made from steel or semi-steel, threaded or flanged.

EDCO makes strainers for steam — air — gas and fluids. Write today for detailed data on these products. They offer you many savings. Ask for Bulletin 863.

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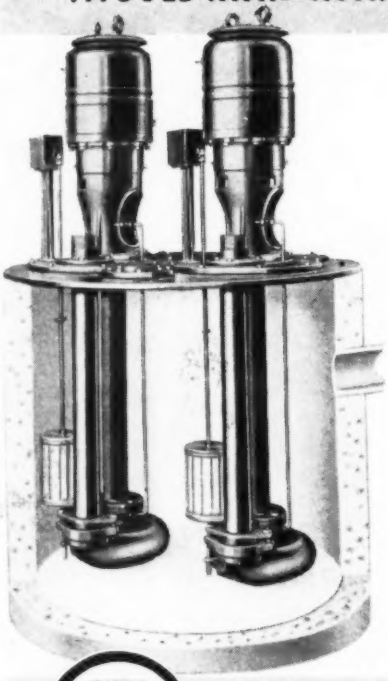
... DOES AWAY WITH SCREENING AND CLEANING!



Here, again, Economy design improves pump performance and *cuts maintenance costs* by eliminating need for strainers, and disagreeable job of cleaning them.

The wide Economy impeller has smooth, clear passages that allow solids and rags to pass without danger of catching or clogging, an important advantage in the handling of domestic or industrial sewage, solids, or pulpy materials. Economy Sump Pumps are able to *sustain* high rated efficiency with minimum attention, by virtue of these additional engineered features:

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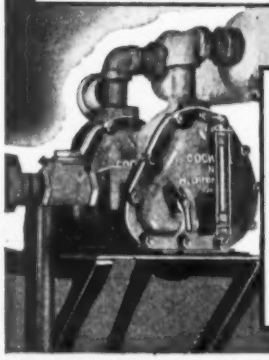
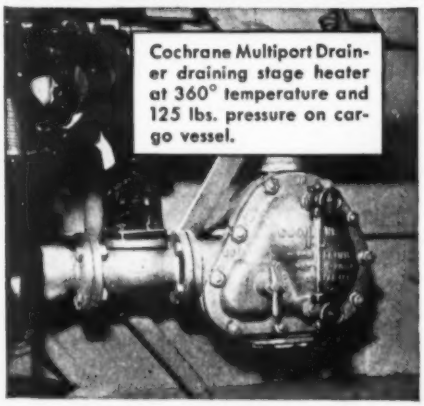


Two Cochrane Multiport Drainers handle condensate returns for process, in a large southern printing plant.



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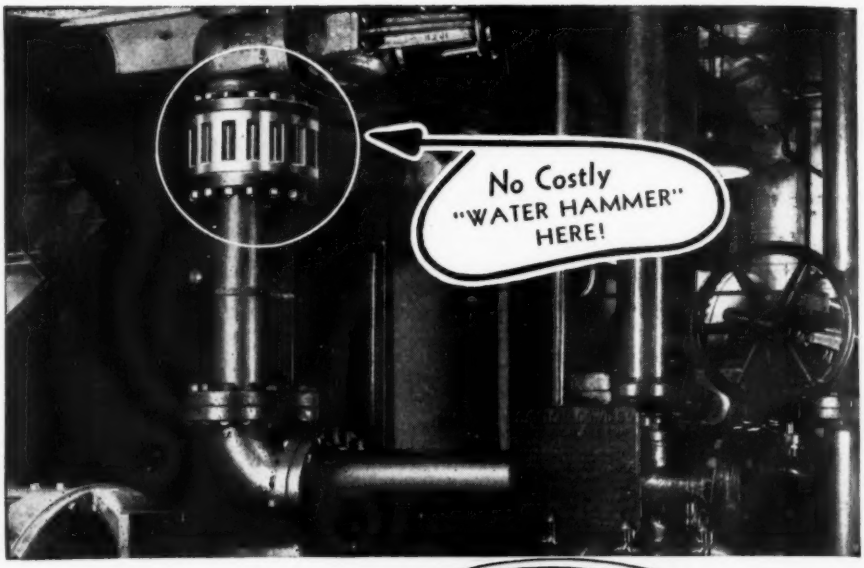

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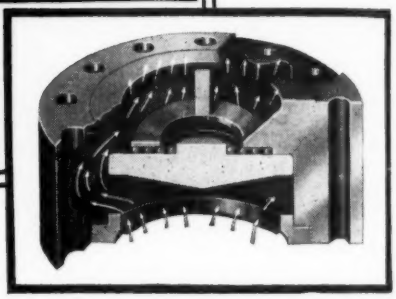

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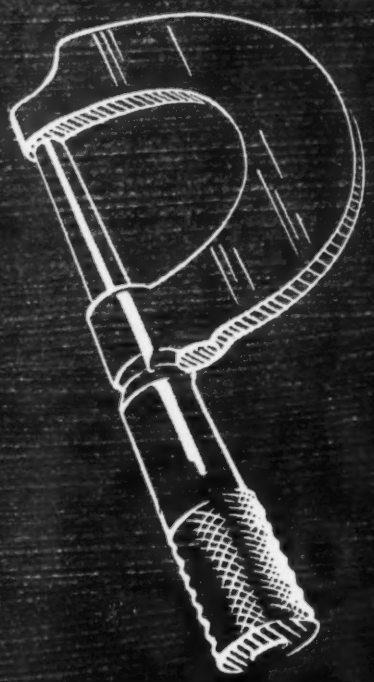

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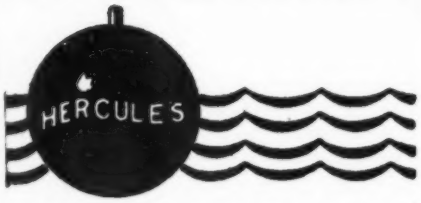

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The dependability of Rockwell Valves is based on many thousands in use under varying operating conditions. Investigate their possible applications for your plant.

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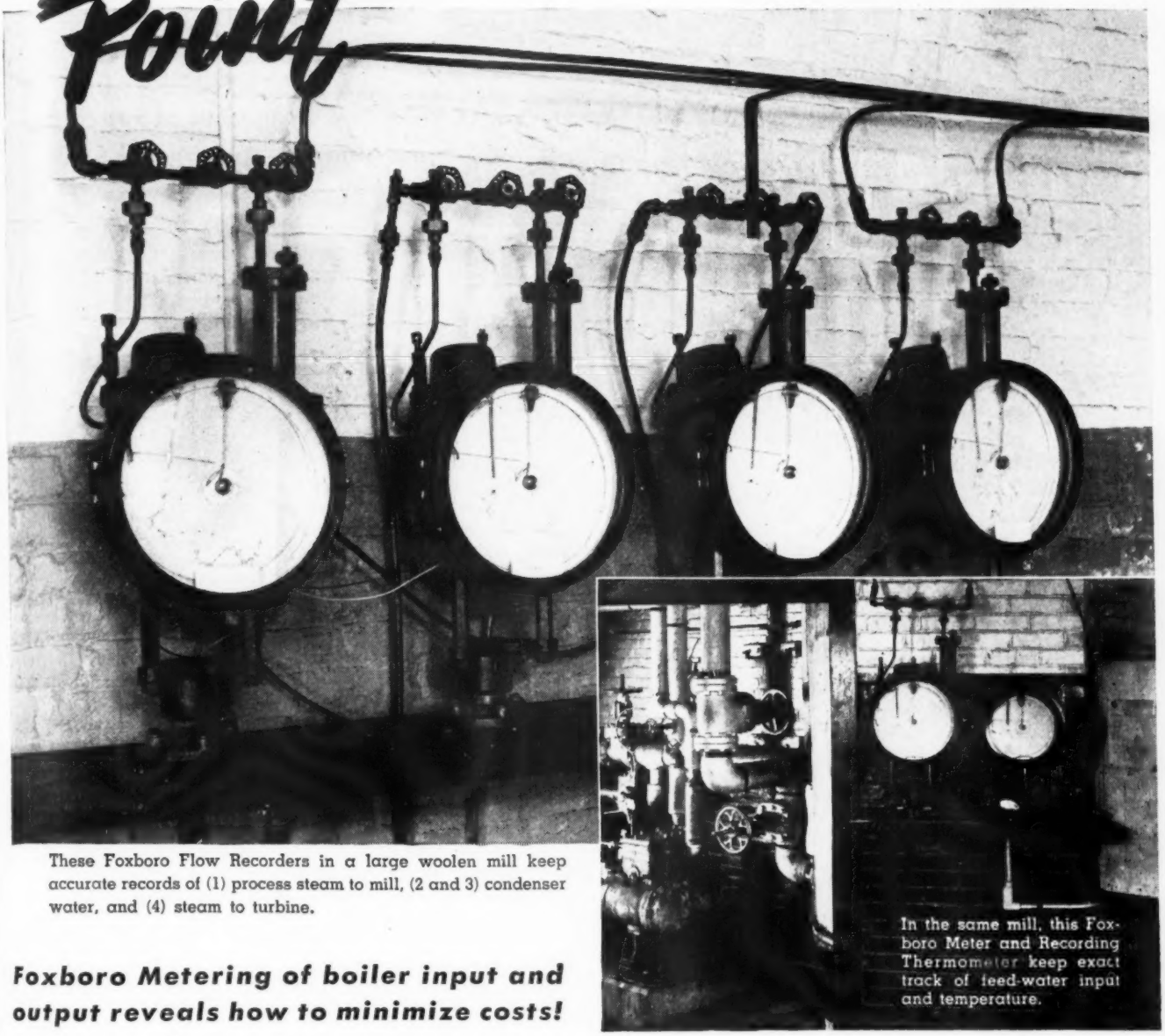

These Foxboro Flow Recorders in a large woolen mill keep accurate records of (1) process steam to mill, (2 and 3) condenser water, and (4) steam to turbine.

In the same mill, this Foxboro Meter and Recording Thermometer keep exact track of feed-water input and temperature.

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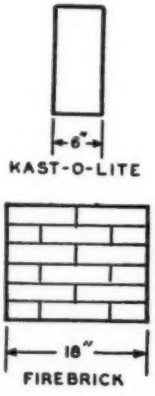
Because KAST-O-LITE is not only a castable—or just an insulation—but a dependable combination of both—it offers a wide range of uses. Wherever insulating refractory properties are desired, KAST-O-LITE offers construction advantages and economy. For complete linings, walls, arches or special shapes.

Easy to Use

KAST-O-LITE, as its name implies, may be cast into place using simple formwork in much the same manner as structural concrete. Mix with water and puddle or pour. Furnace walls, arches, linings or back-up are placed in monolithic sections. Shapes can be made easily and quickly.

Cuts Fuel Bills!

SAVES—REDUCES HEAT LOSSES



The light weight and composition of KAST-O-LITE means that less heat is lost through the lining. Thermal conductivity as used is only approximately 30% that of heavy firebrick. This denotes only 6" of KAST-O-LITE is equal to 18" of firebrick in insulating value. Closer temperature control is possible. Fuel savings result.

And because KAST-O-LITE weighs only 78 lbs. per cubic foot the weight of the lining can be reduced approximately 50% as compared with heavy firebrick.

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A LIGHT WEIGHT Mix and Pour REFRACTORY
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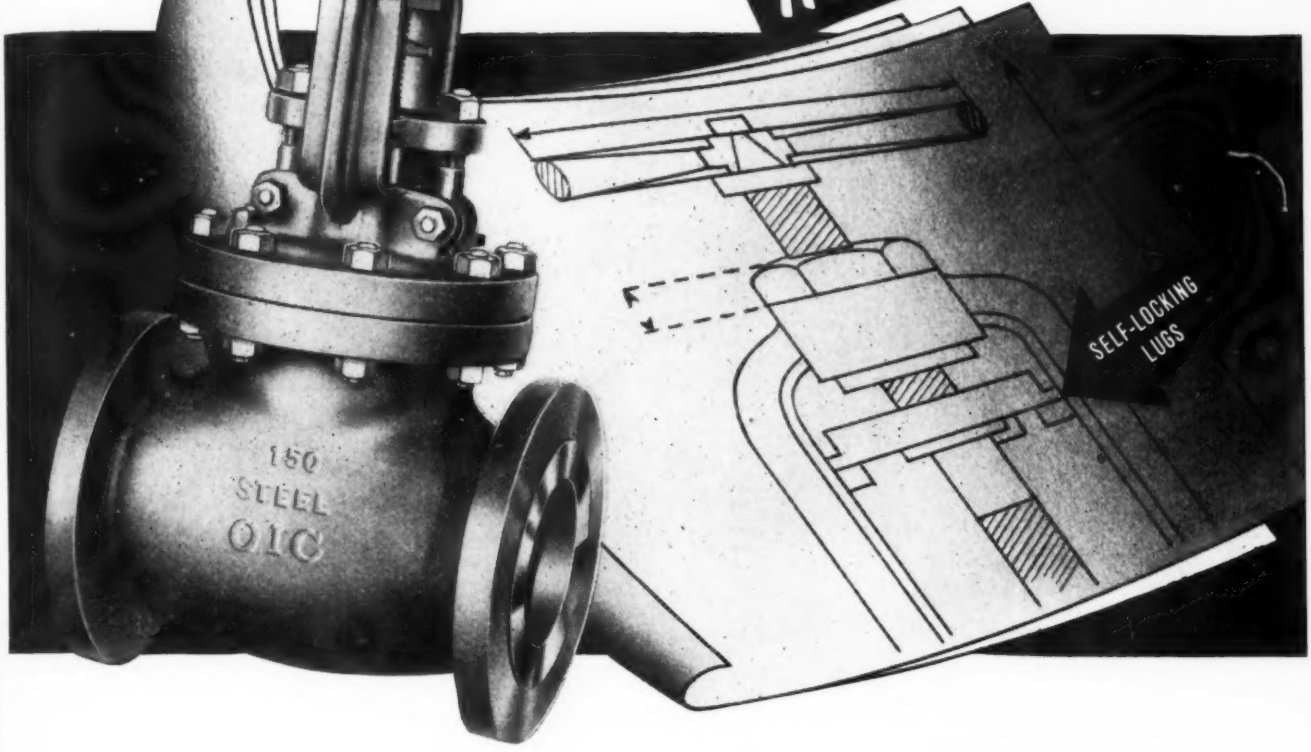
YES! THE OIC STEEL GLOBE VALVE HAS IT TOO!



Yes! The OIC Steel Globe Valve . . . like the Steel Gate Valve . . . *has:*—

(1) The "Helps Repack Itself" feature•

(2) Eye-bolts holding the packing••

(3) Full-threaded bonnet stud bolts•••

There is an OIC Distributor near you ready to demonstrate these and the many other exclusive features of OIC Steel Valves to you. Call him or write to us for complete details.

•*Tongued shelves on yoke arms and keyed follower hold packing unit up out of the way permitting faster, better packing under pressure. (Patent Pending.)*

••*Cannot be lost or misplaced like stud bolts.*

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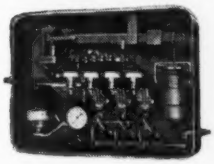

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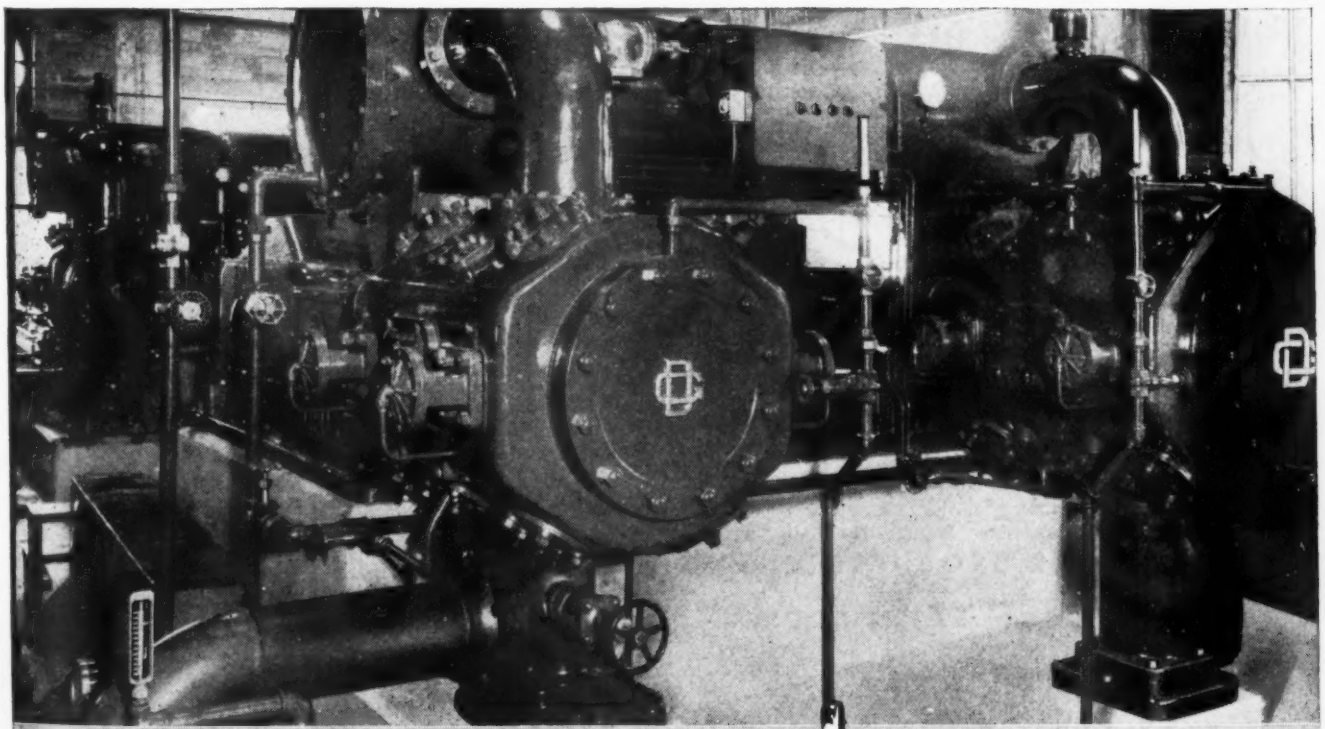

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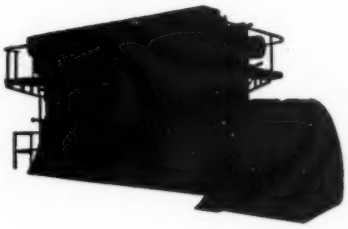

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"Worn, leaky, faulty valves—that's one worry we don't have!" say plant operators who installed Darling Double Disc Gate Valves—many as far back as 30 years before this war.

Today valve wear can be a *real* worry because it means new valves, and they're mighty hard to get. But regardless of how severe the operating conditions, or the materials involved, Darling Double Disc Gate Valves go right on, year after year, delivering tighter seating, better performance, less wear, more efficient operation, at lowest possible maintenance cost.

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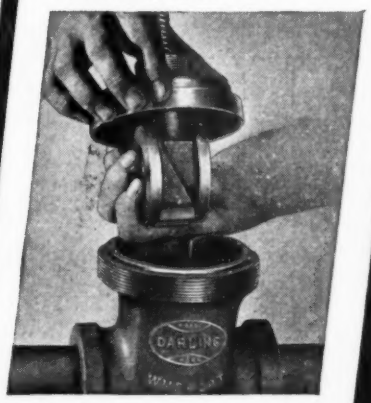
Two discs and two wedges—the entire working part assembly of a Darling Double Disc Gate Valve. There is no other valve with this design. The seats are parallel. The discs are *fully revolving*, seating in a different position each time the valve is operated. This means tighter seating, less wear, longer operation and lower maintenance costs with Darling Gate Valves.



You don't have to take a Darling Double Disc Gate Valve out of the line to replace the parts. Simply insert new, inexpensive parts; replace Stem and Bonnet. Valve is again ready for long, hard service.

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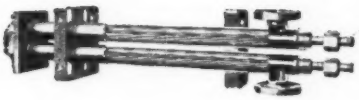
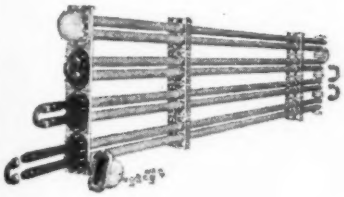
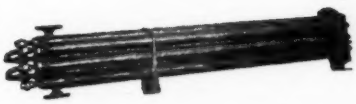


Single TWIN G-FIN SECTION ... a standard interchangeable unit manufactured on a production basis for quick shipment



Stack of four TWIN G-FIN SECTIONS connected in series for greater temperature range



Triple G-FIN SECTION ... a particularly compact, light-weight unit requiring minimum head room

G-FIN STORAGE TANK OIL HEATER ... an application of G-Fin elements to a shell-and-tube unit that provides greater heating effectiveness than with bare tubes.

All claims for TWIN G-FIN SECTION design . . . construction . . . ratings . . . performance . . . are based upon unmatched length and range of experience and service records.

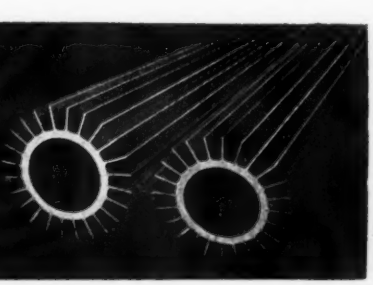
That's why these units are being used on a greater variety of heat transfer services than any other design on the market, and why so many users order additional TWIN G-FIN SECTIONS after a trial installation.

Many hundreds of these units are being used as fuel oil heaters, and they also have many industrial and chemical process applications. Write for bulletin describing these units in detail.

THE GRISCOM-RUSSELL CO., 285 Madison Ave., New York 17, N. Y.

The Griscom - Russell "E" award now has THREE stars for continued excellence in war production.

GRISCOM-RUSSELL
TWIN G-FIN SECTION
The Universal Heat Exchanger



STRENGTH

FOR SAFETY AND LONG-TIME SERVICE

Specify

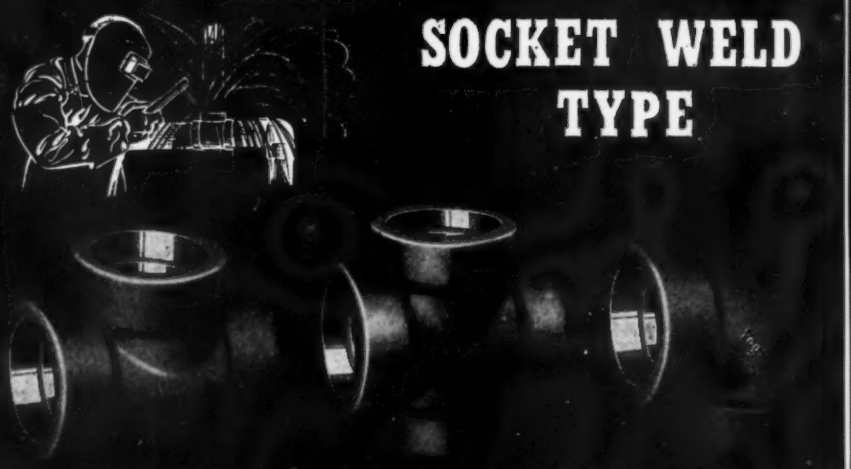
Vogt

DROP FORGED STEEL FITTINGS

SCREW END TYPE

For 2000, 3000 and 6000 pounds service — Sizes 1/8" to 6"

SOCKET WELD TYPE



For schedules 40, 80 and 160 pipe — Sizes 1/8" to 6"

Round-the-clock operation of oil refineries, chemical plants, steam plants, etc., essential to the continuous flow of war products to the United Nations, is all in the day's work for these fittings. Today, as in peacetime, Vogt drop forged steel fittings make a major contribution to the efficient functioning of pipe lines in plants vital to the war effort.

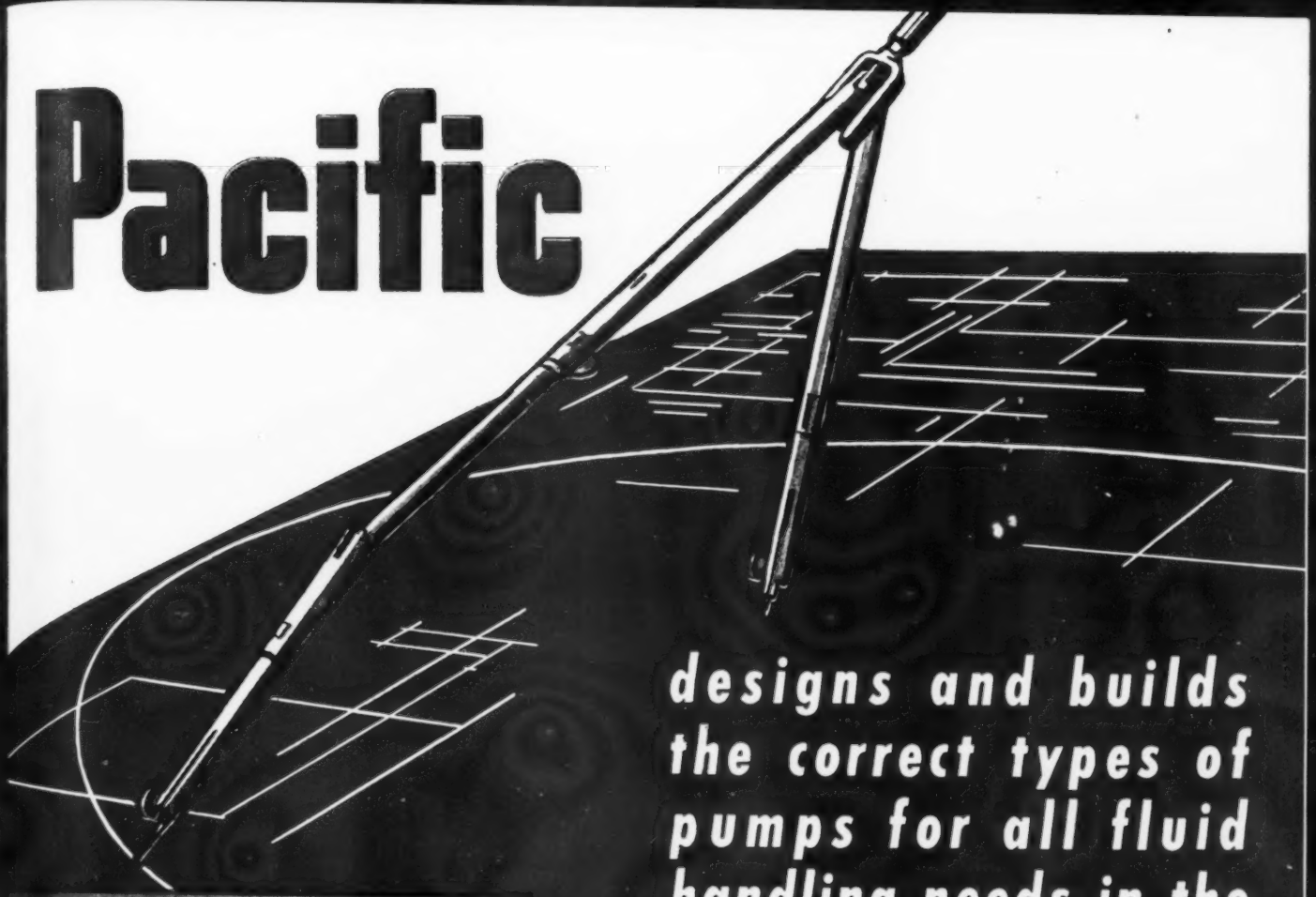
Shocks and stresses imposed by high pressures and high temperatures are taken in their stride because Vogt fittings are uniform in structure, fine grained, and free from porosity . . . the superior product of laboratory controlled matorials and giant forging hammers and upsetters. These properties also give higher resistance to erosive and corrosive conditions, thereby adding to service life expectancy.

Vogt Ells, Tees, Crosses, etc., are forged from carbon steel or various alloys to meet specific operating conditions. Catalog F-8 will aid you in their selection and proper application.

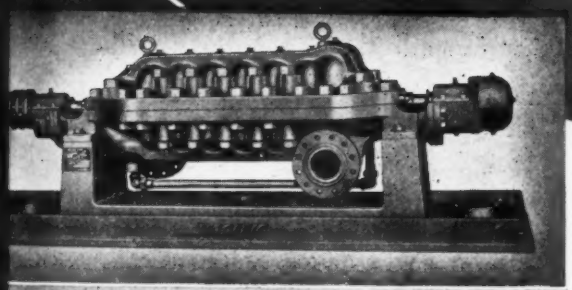
HENRY VOGT MACHINE CO., Inc., LOUISVILLE 10, KY.

BRANCH OFFICES: NEW YORK • PHILADELPHIA • CLEVELAND • CHICAGO • DALLAS

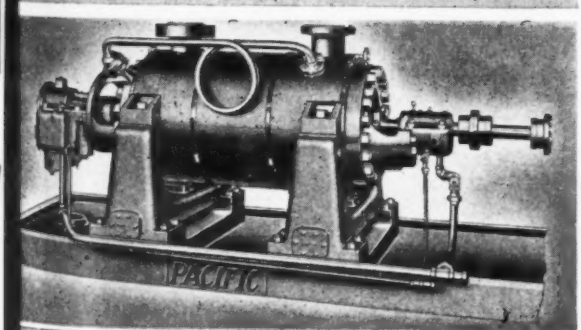
Pacific



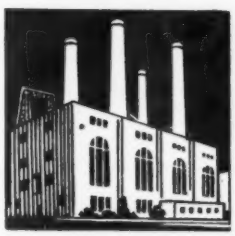
designs and builds the correct types of pumps for all fluid handling needs in the utility field



PACIFIC Type JH—7-Stage Boiler Feed Pump installed by a large municipality.



PACIFIC Type IMB—Multi-Stage Boiler Feed Pump installed by a leading Mid-West Utility.



What are the variables in your pumping operations? What are the general conditions that surround your pumping requirements? How can you obtain the highest pumping efficiency thru the application of the right pump—for the specific job? These are questions on which you want correct answers.

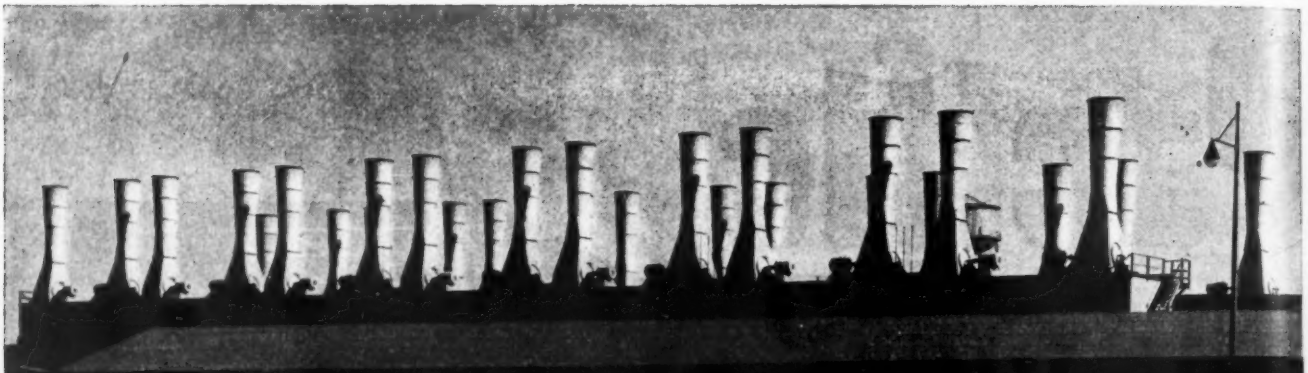
Pacific Pump Works engineers and builds *many major lines of pumps in all standard sizes.* This wide range of pumps was developed to meet your exact needs, no matter where you are operating, or under whatever variables your pumps are encountering.

Want to know *exactly* the correct pump to use for each of your particular pumping conditions? Give the facts to a Pacific representative or service engineer. Consistent with manpower and material availabilities, you will be given full data on the pump or pumps you need. They will also tell you frankly what priorities are required, what deliveries can be made.

PACIFIC PUMP WORKS · Huntington Park, Calif.
One of the Dresser Industries

MID-CONTINENT PUMP SUPPLY CO. · Tulsa, Oklahoma
A Division of Pacific Pump Works

PACIFIC *Engineered* PUMPS



Conserve Critical Materials

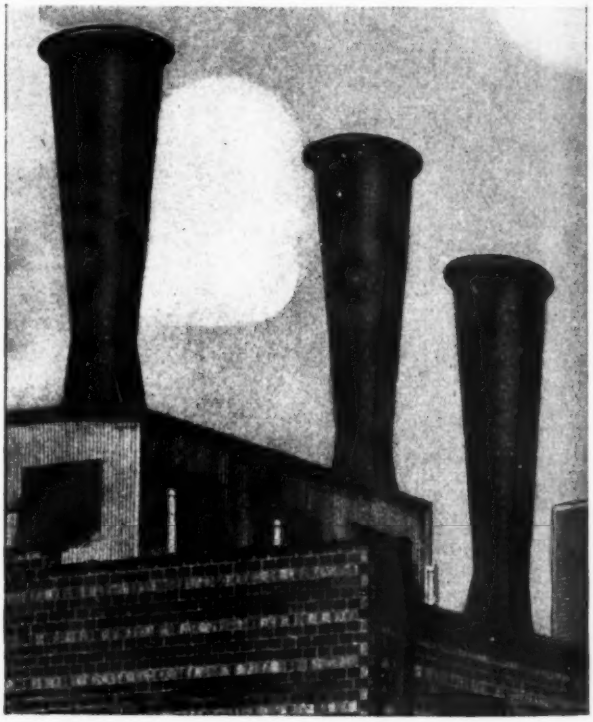
These Fan Stacks are evacuating dangerous gases to atmosphere. Their construction, when driven by weather-proof motors, eliminates the necessity of housing.

When you install a Thermix Fan-Stack you not only save steel vitally needed for the war, but also save money.

No connecting breeching is required between the fan and chimney as with an ordinary fan and stack—no complicated ducts are needed as with a double inlet fan. Thermix Stacks are of smaller average diameter than a cylindrical stack or chimney, and only one support (instead of separate supports) is needed for the Thermix Fan and Stack combined. Consequently, they cost less for material and less for labor.

The Thermix is a combination of a fan and a stack in *one* unit which operates as a single unit. Because it is designed and built by a single, responsible manufacturer, you are assured complete coordination of the mechanical-draft stack, the inlet-breeching and the fan itself.

Our Catalog No. 109 gives full particulars, Write for a copy.



PRAT-DANIEL CORPORATION, Port Chester, N. Y.

Also manufacturers of non-priority dust collectors.

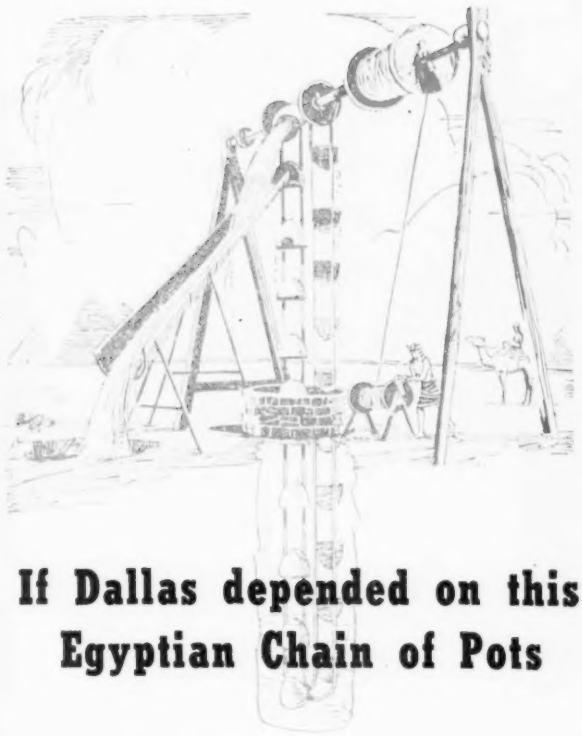
THERMIX ENGINEERING CO., Greenwich, Conn.

Project Engineers

Representatives in Principal Cities

THERMIX FAN STACK

"City in the Sky"--the Mercantile Bank Building, Dallas, Texas. Youngstown Pipe used for plumbing, heating and air-conditioning. Architect, Walter W. Ahlschlager, general contractor, Henger Construction Co., plumbing sub-contractor, C. Wallace Plumbing Co. -- all of Dallas.



If Dallas depended on this Egyptian Chain of Pots

THE citizens of Dallas take justifiable pride in this new skyscraper . . . the 30-story Mercantile Bank Building.

Yet who appreciates that this "City in the Sky" was possible only because of the availability of modern piping systems--the only practical means to service every floor of its magnificent 30 stories with water.

Imagine what this building, housing thousands of workers, would be like with no water or modern heating facilities. Picture the impossibility of this structure in Ancient Egypt, dependent on the then ultra-convenient chain of earthenware pots to draw water from wells.

In order to live in cities, civilized men must have water close at hand . . . and to have water we must have dependable pipe . . . pipe low enough in cost so that it can be used plentifully, pipe durable enough that it will withstand the ravages of time and the hardships of extraordinary service. Steel pipe is the answer to all of these requirements.

The architect who specified Youngstown Pipe for this job and the contractor who bought and installed it, know of its enviable record in other outstanding installations.

YOUNGSTOWN

THE YOUNGSTOWN SHEET AND TUBE COMPANY

YOUNGSTOWN 1, OHIO

Manufacturers of

Carbon, Alloy and Yoloy Steels

QUALITY YOUNGSTOWN SERVICE

Pipe and Tubular Products - Sheets - Plates - Conduit - Bars - Coke Tin Plate - Electrolytic Tin Plate - Rods - Wire - Nails - Tie Plates and Spikes.

ROCKBESTOS A.V.C.

Takes "SPECULATION" out of Wire Performance in HOT Locations

THE ROCKBESTOS CONSTRUCTION THAT PROVIDES LONG WIRE LIFE

Rockbestos A. V. C. Power Cable, at right, and similarly insulated Motor Lead Cable (Underwriters' and Nat. Elec. Code, Type AVA) has a maximum operating temperature rating of 110° C. (230° F.) and this permanently insulated construction:

1 The conductor is perfectly and permanently centered in helically applied insulation.

2 Felted asbestos insulation, impregnated with heat, flame and moisture resisting compounds, withstands conductor heating overloads and won't dry out, bake brittle or burn.

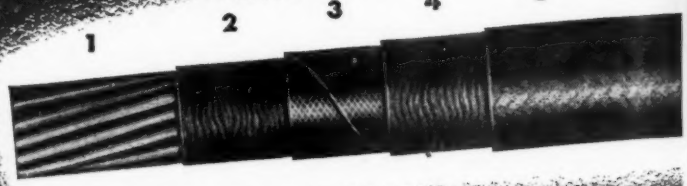
3 Lubricated varnished cambric for high dielectric strength and added moisture resistance, protected from heat, flame and oxidation between two felted asbestos walls.

4 Outer felted asbestos wall, also impregnated with heat, flame and moisture resistant compounds, serves as an effective barrier against high ambient temperatures and flame.

5 A tough, rugged asbestos braid, resistant to heat, flame, moisture, oil, grease and corrosive fumes.

One of 122 different wires and cables developed for severe operating conditions by Rockbestos.

WON'T bake brittle, bloom, burn or rot.
RESISTS moisture, oil, grease and fumes.



Take an electrical circuit that runs around or next to a hot strip mill, soaking pit, forging press, steam tunnel, lehr, kiln, etc.,—and you're really "speculating" with wire performance *unless* the wire used has an insulation that will stand up under the high operating temperatures.

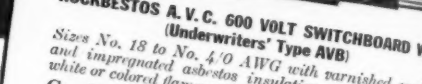
Rockbestos A. V. C. takes the "speculation" *out* of wire performance in hot spot locations. Its *permanent asbestos insulation* provides trouble-free circuits because it resists heat, flame, oil, grease, moisture and corrosive fumes, and won't bake brittle, bloom, flow, rot or crack under heat or severe operating conditions.

Put performance insurance in your circuits . . . wire with *permanently* insulated Rockbestos A. V. C. There are 122 standard constructions available to meet practically every service requirement. When inquiring or ordering, please furnish CMP allotment number or symbol and certification. For complete information and samples, write nearest branch office or:

ROCKBESTOS A. V. C. 600 VOLT SWITCHBOARD WIRE
(Underwriters' Type AVB)

Sizes No. 18 to No. 4/0 AWG with varnished cambric and impregnated asbestos insulation and gray, black, white or colored flameproof braid.

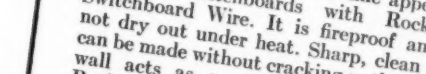
Combine fire insurance and fine appearance in your switchboards with Rockbestos Switchboard Wire. It is fireproof and will not dry out under heat. Sharp, clean bends can be made without cracking as the asbestos wall acts as a cushion under the braid. Rockbestos AVC Hinge Cable and Switchboard Bus Cable have the same fireproof and heatproof characteristics.



ROCKBESTOS A. V. C. 600 VOLT MOTOR LEAD CABLE
(Underwriters' Type AVA)

Size No. 18 AWG to 1,000,000 CM insulated with two walls of impregnated asbestos and a high-dielectric varnished cambric insert, with a heavy asbestos braid overall.

Heatproof, fireproof, greaseproof and oilproof, will not dry out and crack, won't burn or carry flame, and remains permanently flexible. For coil connections, motor and transformer leads where extreme heat and fire hazards are encountered as in steel mills, etc.



ROCKBESTOS ALL-ASBESTOS FLEXIBLE CORD

Sizes No. 10 to 18 AWG with two or three conductors insulated with felted asbestos, covered with asbestos braid. Also in A. V. C. (asbestos and varnished cambric) high-dielectric constructions.

This heat-resisting flexible cord is ideal for high-wattage lighting units, floodlights, blue-print machines, apparatus, etc., which require a heavy duty, enduring cord. For moisture-resistant construction specify the A. V. C. type. Labeled cord with polarized conductors if desired.

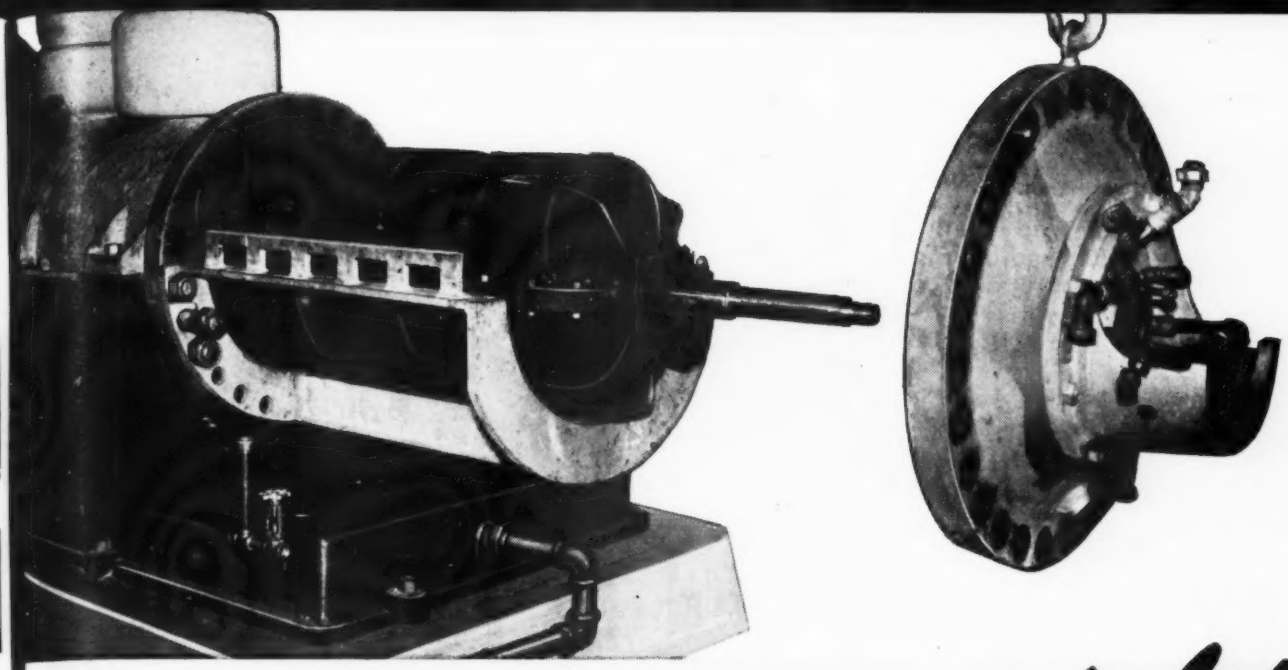
ROCKBESTOS PRODUCTS CORPORATION, 947 Nicoll Street
New Haven 4, Conn.

FOR VICTORY BUY WAR BONDS

ROCKBESTOS A.V.C.

The Wire With Permanent Insulation

NEW YORK, BUFFALO, CLEVELAND, CHICAGO, PITTSBURGH, ST. LOUIS, LOS ANGELES, SAN FRANCISCO, SEATTLE, PORTLAND, ORE.



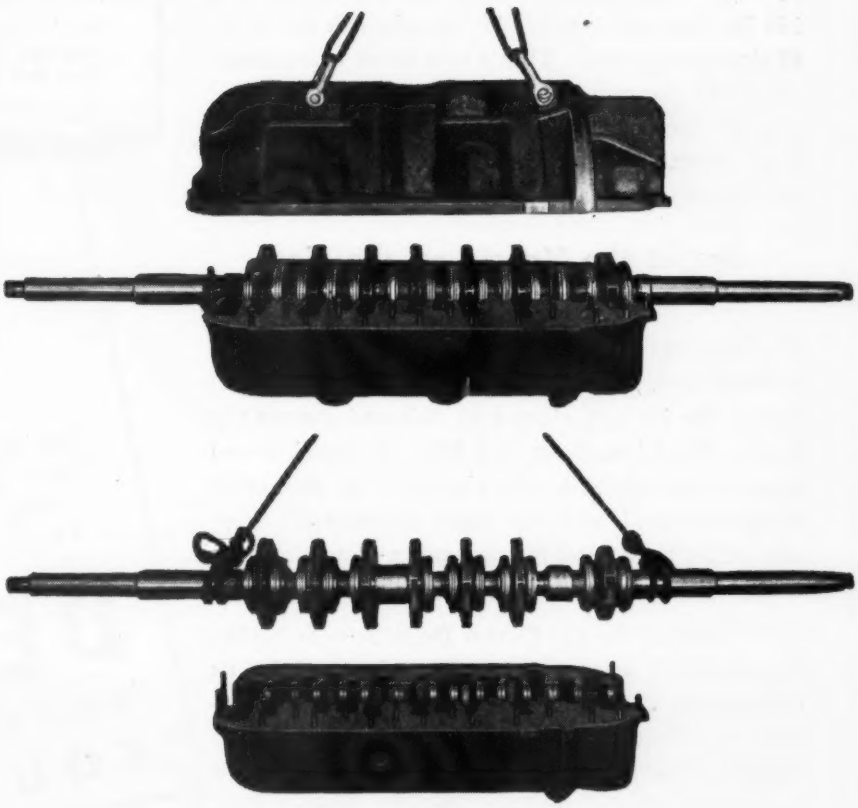
Accessibility

For those occasions when internal inspection or repairs are to be made, ease of erection and disassembly are all-important. This series of photographs illustrates the ease of disassembly of a Byron Jackson Double Case Boiler Feed Pump better than it can be described.

(Above) After removal of pump half coupling and outboard bearing assembly, the outer barrel cover is unbolted and removed; the dismantling cradle is then attached to barrel, and the entire inner pump case and rotating element assembly are pulled from the barrel onto the cradle. It is unnecessary to disturb the main piping or driver to perform these operations.

(Right) The upper half of the inner case is next raised (after unbolting the few small studs which position the two halves) exposing the entire rotating element, the inner case, and all stationary wearing parts.

The complete rotating element is then lifted from the case. Reasonable time for dismantling and re-assembly of any Byron Jackson Double Case Boiler Feed Pump is from 8 to 12 hours.—Detailed, illustrated bulletin, describing many other features, available upon request.



BYRON JACKSON CO.

GENERAL OFFICES: LOS ANGELES, CALIFORNIA

FACTORIES: Los Angeles and Fresno, California; Houston, Texas; Bethlehem, Pennsylvania. SALES OFFICES: New York, Chicago, San Francisco, Fresno, Salt Lake City, Tulsa, El Paso, Houston.

LOST!

Somewhere in the plant — steam, air, water and oil, man-hours, machine production, and dollars. Finder please notify management. REWARD

Have you looked in the Valves?

THE LOSS MAY BE THERE!

Even seasoned, canny plant men are amazed when they see the *inside story* of valve leak costs. The Dexter Chart (sent free) shows that the equivalent of a 1/32" hole across the seat of a closed valve in 100 lb. lines will lose 69,552 lbs. of air or 3,175 lbs. of steam per month. That's *one* valve *one* month. Now add the other valves — production delays — process spoilage — costly repairs — shutdowns — and new valves (which are hard to get), and we see why more and more valve owners

Reseat the Valves on the Line The DEXTER Way

One man can reseat any globe, gate or pump valve without removing it from the Line. He merely removes the bonnet, stem and disc and inserts the Dexter Machine. Seats and Disc are quickly and easily reseated, with all wire grooves and score marks removed, and the valve reassembled actually better than new! No new parts — no slow and costly breaking-out of old valve — no long delays.

Write today for the Dexter Bulletin — or better, tell us about your worst leaky valve and let us recommend the machine and quote its cost. Remember, Dexter Valve Reseating Equipment, by stopping costly valve leaks, usually pays for itself in a few months' time. Don't delay — write today.

FOUND!

in leaky valves throughout the plant — air, gas, water, oil and steam that were wasting thousands of dollars and causing delays in War Production — now put back to useful work by

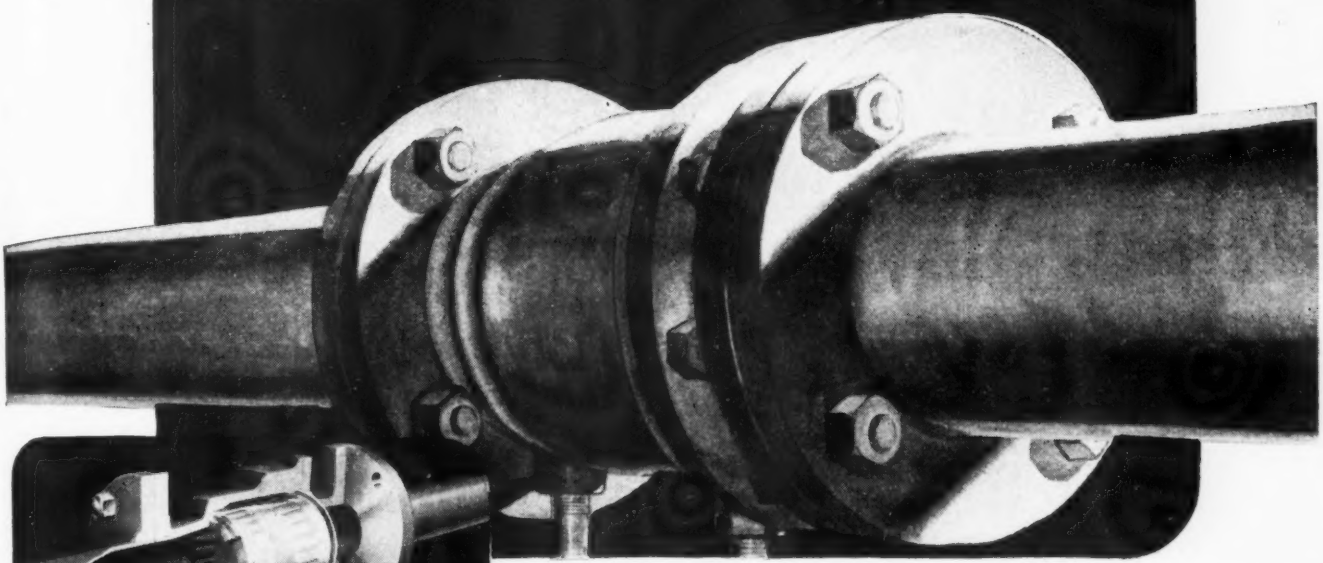
FOR GLOBE, GATE AND PUMP VALVES

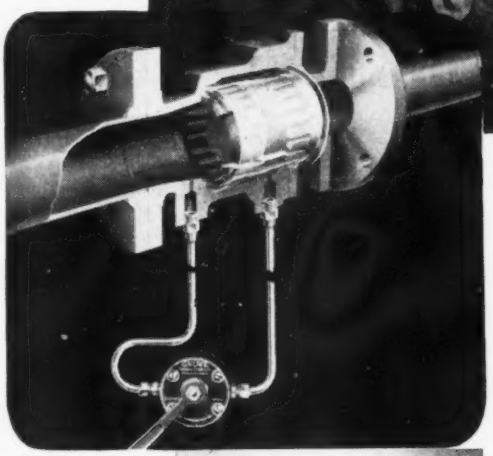
DEXTER VALVE RESEATING EQUIPMENT

THE LEAVITT MACHINE COMPANY
ORANGE, MASSACHUSETTS

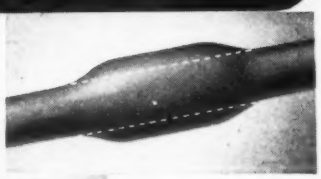
GROVE *Flexflo Remote Control* VALVES

HANDLE HIGHLY CORROSIVE AND EROSIVE LIQUIDS & GASES





EXPANDS TO OPEN



CONTRACTS TO CLOSE BY *Remote Control*

EMPLOY JUST ONE NON-METALLIC MOVING PART TO OPEN OR CLOSE

The fully self-contained, self-operating Grove Fexflo Remote Control Valve is automatically self-compensating for abrasive wear resulting from the transmission of fluids containing sand or other small solid particles. It is designed for any fluid service such as handling oil, water, salt water, chemical solutions, gases and air. Its flexible expansible tube overcomes not only the problems of erosion but also that of corrosion and electrolytic action, commonly encountered in ordinary valves. The Grove Flexflo establishes a new low in valve maintenance. Adjustments or servicing are seldom if ever required. Just one non-metallic moving part operates to open and close the valve. The tube and core, after extended periods of constant and severe service, can be quickly replaced. No machining, grinding, lapping or other operations are necessary. Exhaustive "LIFE TESTS" disclose that after opening and closing more than 250,000 times, the Flexflo Valve shows no perceptible wear. Positive bubble-tight, air-tight shutoff at maximum working pressure—as well as smooth non-turbulent streamline flow is definitely assured at all times.

Write for full details today. Ask for bulletin 800.

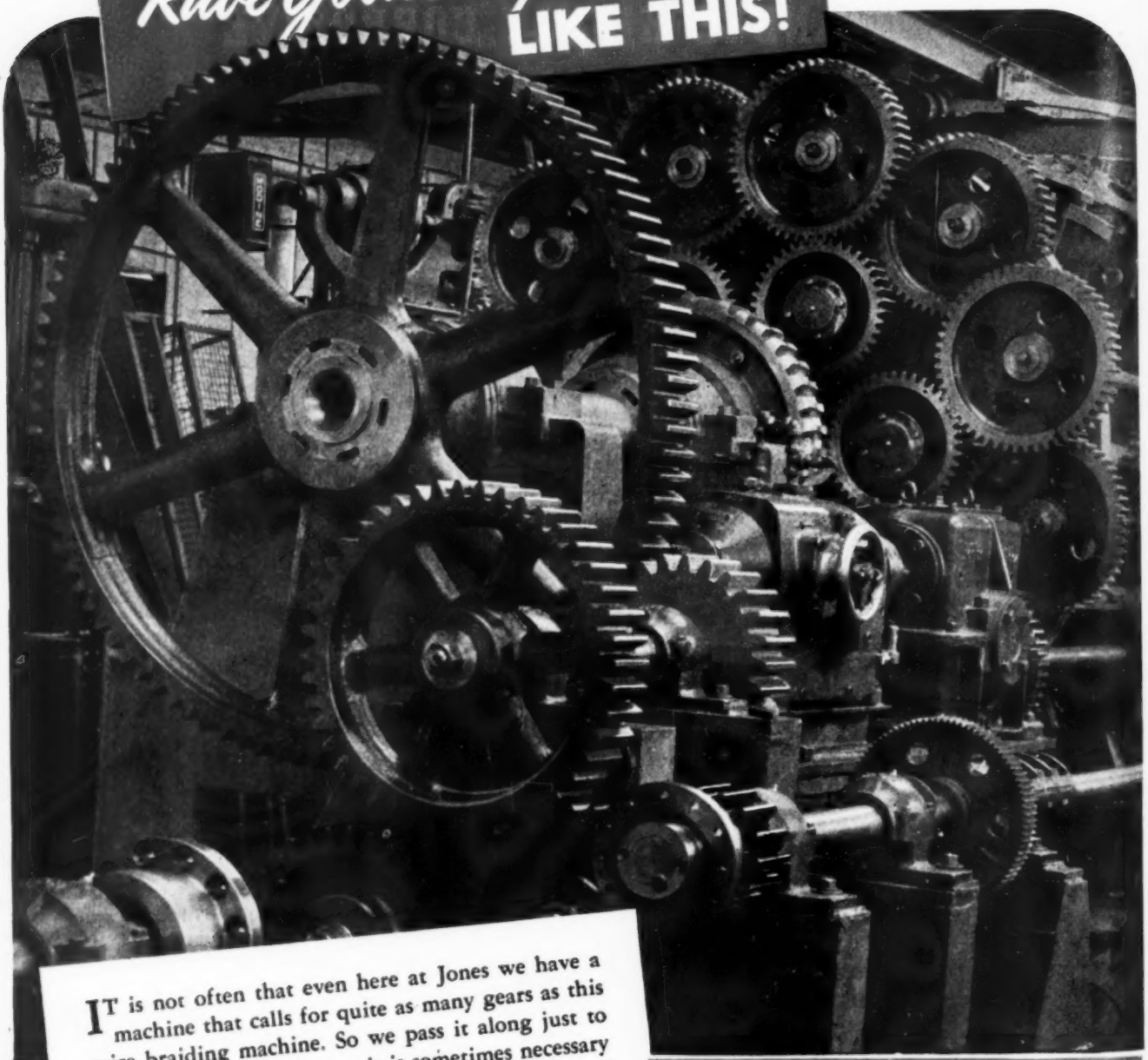
GROVE *Flexflo* VALVES

GROVE
SIMPLICITY
ACCURACY
SAFETY

GROVE REGULATOR COMPANY
6547 GREEN STREET, OAKLAND 8, CALIFORNIA. *Branch Offices:* 30 Rockefeller Plaza, New York 20 • 5644 Navigation Boulevard, Houston 11, Texas • 1930 West Olympic Boulevard, Los Angeles 6, California

WRITE TODAY FOR BULLETIN 800

Rube Goldberg WOULD LIKE THIS!



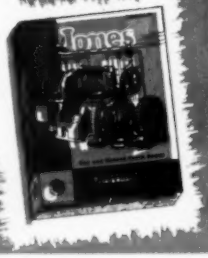
IT is not often that even here at Jones we have a machine that calls for quite as many gears as this wire braiding machine. So we pass it along just to show that even in industry it is sometimes necessary to fall back on the famous Rube Goldberg type of mechanism to handle some specific operation.

But the cut spur gears and speed reducers on this machine are typical of the thousands that are being turned out for all types of wartime applications. And the other gears in the Jones line whether Herringbone, Worm, Bevel or Mitre are playing their part on land, sea and in the air. These gears and also pinions are produced in high test cast iron, steel, bronze or non-metallic material.

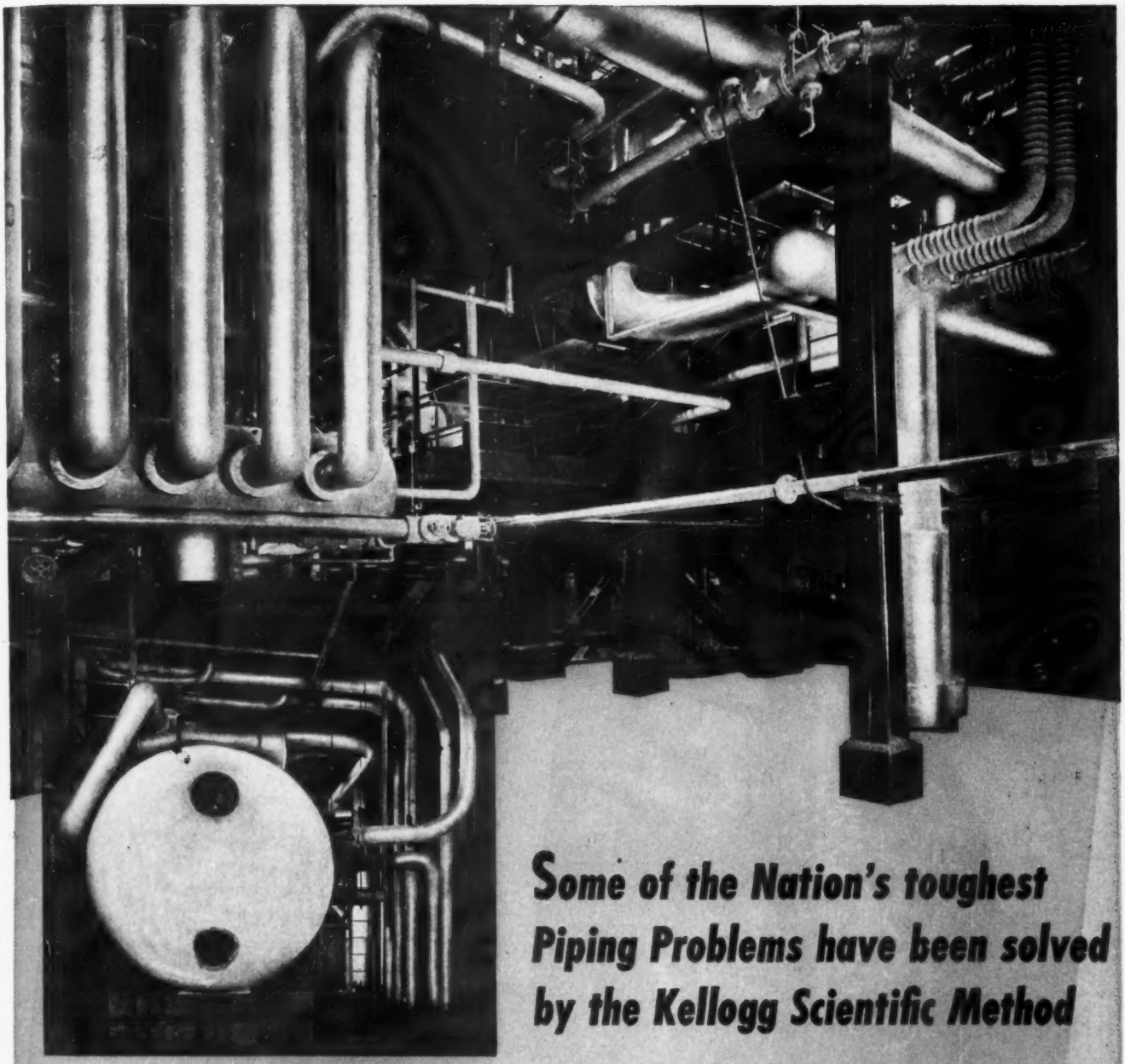
W. A. JONES FOUNDRY & MACHINE CO.
4423 Roosevelt Road, Chicago 24, Illinois

Jones

HERRINGBONE • WORM • SPUR • BEVEL SPEED REDUCERS
CUT AND MOLDED TOOTH GEARS • V-BELT SHEAVES
ANTI-FRICTION PILLOW BLOCKS • PULLEYS
FRICTION CLUTCHES • TRANSMISSION APPLIANCES



Catalog No. 71 contains 224 pages of engineering and application information on Jones gears. A copy will be mailed without charge and without obligating you in any way.



Some of the Nation's toughest Piping Problems have been solved by the Kellogg Scientific Method

THE most complicated design problems of high temperature piping systems for central stations, process and marine power plants have been solved by apparatus perfected and used by The M. W. Kellogg Company.

Consulting engineers, power, process and marine engineers when designing complicated piping systems should consult Kellogg. For this scientific method secures exact results, saves time and often substantially reduces the quantity of vital piping material required.

KELLOGG

"Masterflex" Prefabricated Piping Systems • "Masterweld" pressure vessels for Power, Refinery and Chemical Industries. Heat Exchangers. Pyrolytic and Catalytic Cracking Units, Hydroforming, Reforming, Dehydrogenation, Alkylation, Desulphurization. Thermal and Catalytic Polymerization Units • JUIK Processes for Lubricating Oil Plants. Plastic Refractories • Radial Brick Chimneys.

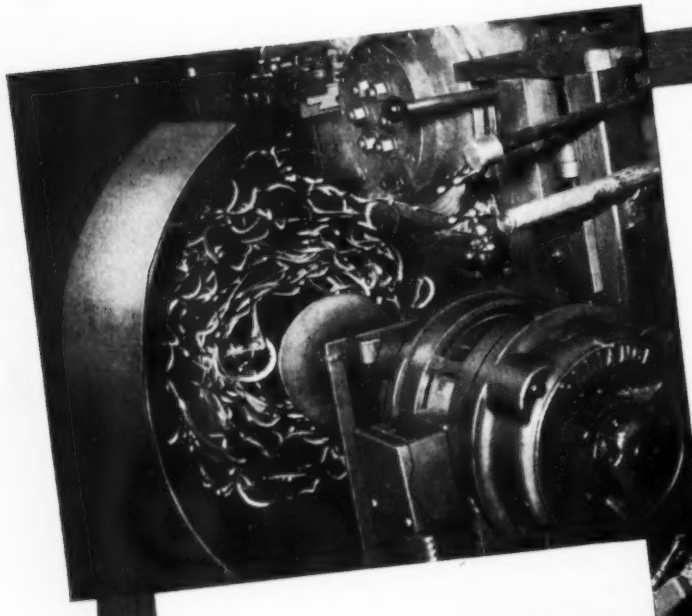
THE M. W. KELLOGG COMPANY • JERSEY CITY, NEW JERSEY • 225 BROADWAY, NEW YORK 7, N. Y.

Representatives: LOS ANGELES: 609 SOUTH GRAND • TULSA: PHILTOWER BUILDING

Seamless or Welded

IT'S THE STANDARD B&W QUALITY

The use of quality steel in the manufacture of Babcock & Wilcox Boiler Tubes—whether seamless or welded—is of major importance in this day of high-pressure, high-temperature boiler installations. Seamless tubes are produced by a piercing operation which also includes a forging action. The electric resistance method welds flat stock into tubes of uniform wall thickness, maximum strength and excellent finish. These characteristics of all B&W Tubes are your guarantee of SAFETY.



SEAMLESS PROCESS ➡

The illustration shows the piercing mill in operation. The round bar is forced over the conical piercing point. This operation also performs a forging action which strengthens the metal structure.

⬅ WELDING PROCESS

In the electric resistance welding method the flat stock, accurately gauged and trimmed, is first formed into tubular shape. In the next operation pressure rolls applied beneath the electrodes force the heated tube edges together to form a weld. All B&W Tubes—seamless or welded—are finished to gauge accuracy and each piece is individually tested.

★ BUY MORE WAR BONDS! ★

THE BABCOCK & WILCOX TUBE CO.

SEAMLESS TUBE DIVISION • *WELDED TUBE DIVISION*

BEAVER FALLS, PA. **ALLIANCE, OHIO**

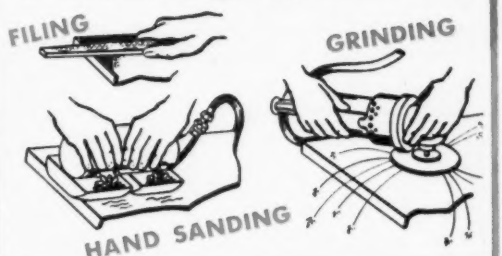
TA-1274

ALL THIS EXTRA SURFACE PROTECTION

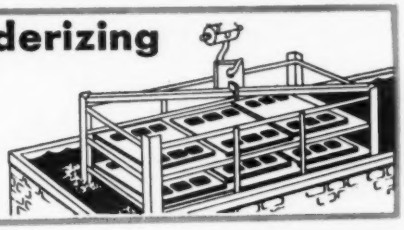
without added cost to you . . . in

I-T-E DRAWOUT SWITCHGEAR

3 Cleaning Operations

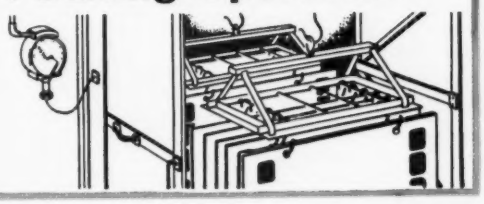


Bonderizing



5 Spraying Operations

4 Baking Operations



2 Mechanical Rubbing Operations

The extra work that I-T-E puts into the finish of a Multumite structure is in the user's interest. Electrically and mechanically I-T-E switchgear is built to serve for years and the finish is in keeping. Your first gain is in maintaining a clean structure. Your second is preservation of the metal. The third—and not the least important—is that after years of use your Multumites will look their part as dependable servants and will continue to earn your respect.

I-T-E employs the best of modern materials and practices. Processing has been standardized in our plant so that finishing operations do not penalize delivery. Equipment and skills combine to give you a definitely superior finish without added charge.

I-T-E engineers will gladly go into all details of Multumite design, operation and construction. Ask the I-T-E representative nearest you or write to I-T-E Circuit Breaker Company, 19th and Hamilton Streets, Philadelphia 30, Pa.

Representatives in Principal Cities

I-T-E AIR SWITCHGEAR

1944

You can always be sure of an Exide

An Exide Battery that is designed for a specific cranking job can be selected with the same assurance of satisfaction under all conditions as can the engine itself. Its complete dependability, long-life, and extreme ease of maintenance means the saving of vital materials . . . and equally vital man hours.

Write for a FREE copy of the Exide catalogue on Heavy-Duty Batteries. It gives you catalog data on how to order, and how to get the most from your Exide Heavy-Duty Batteries for cranking Diesel engines.

The development and refinements that have been made in high speed Diesel engines have been matched, step-by-step, by Exide engineers.

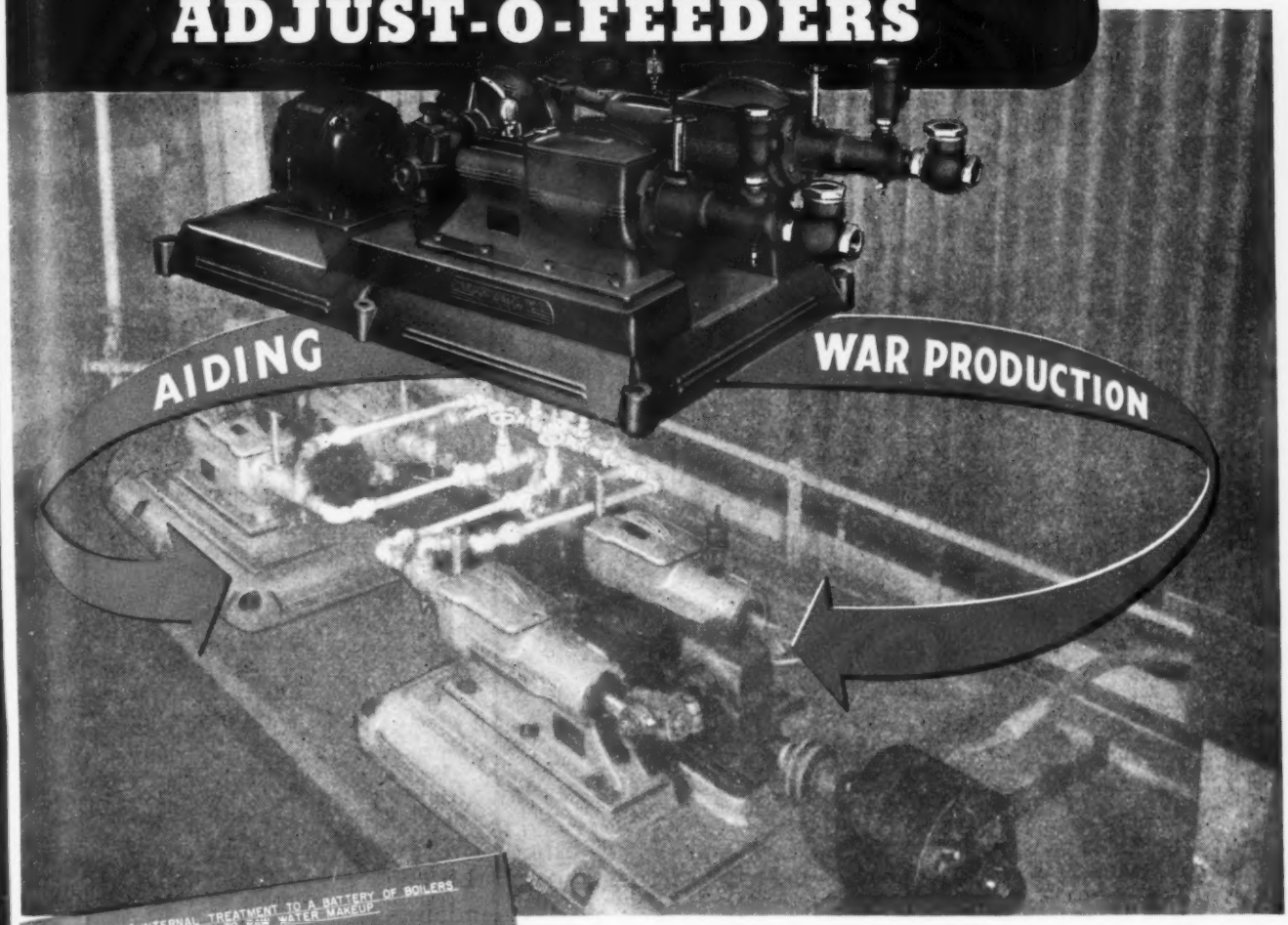
"BUY MORE THAN BEFORE IN THE 5TH WAR LOAN"

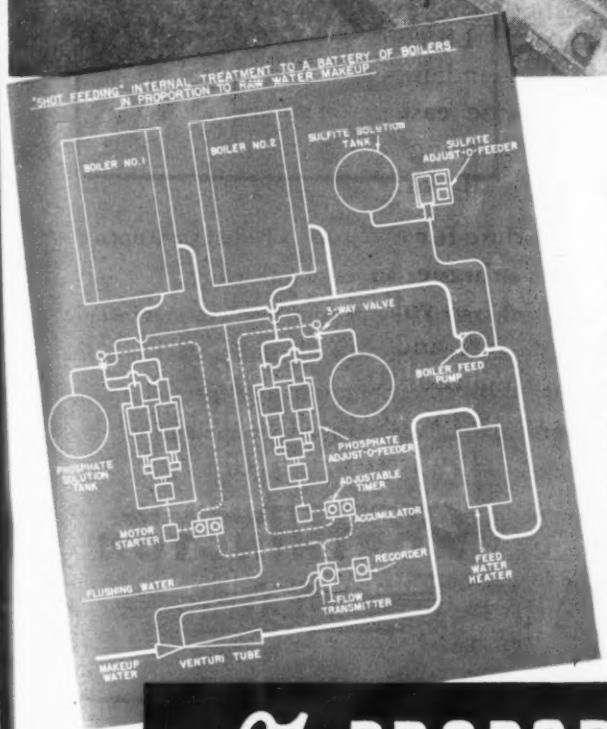
ARMY E NAVY

Exide
BATTERIES
FOR CRANKING
DIESEL ENGINES

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia 32
Exide Batteries of Canada, Limited, Toronto

% PROPORTIONEERS %
ADJUST-O-FEEDERS





FEEDING CHEMICALS FOR BOILER WATER TREATMENT

% Proportioneers % Adjust-O-Feeders, fluid sealed against corrosion and plunger build-up, feed chemicals direct to the boiler drums and feed water heaters in some of our largest war industries. Phosphates, sulphites, sulphates and other conditioning agents are injected against high or low pressures at manually adjusted constant rates, or by automatic flow responsive methods.

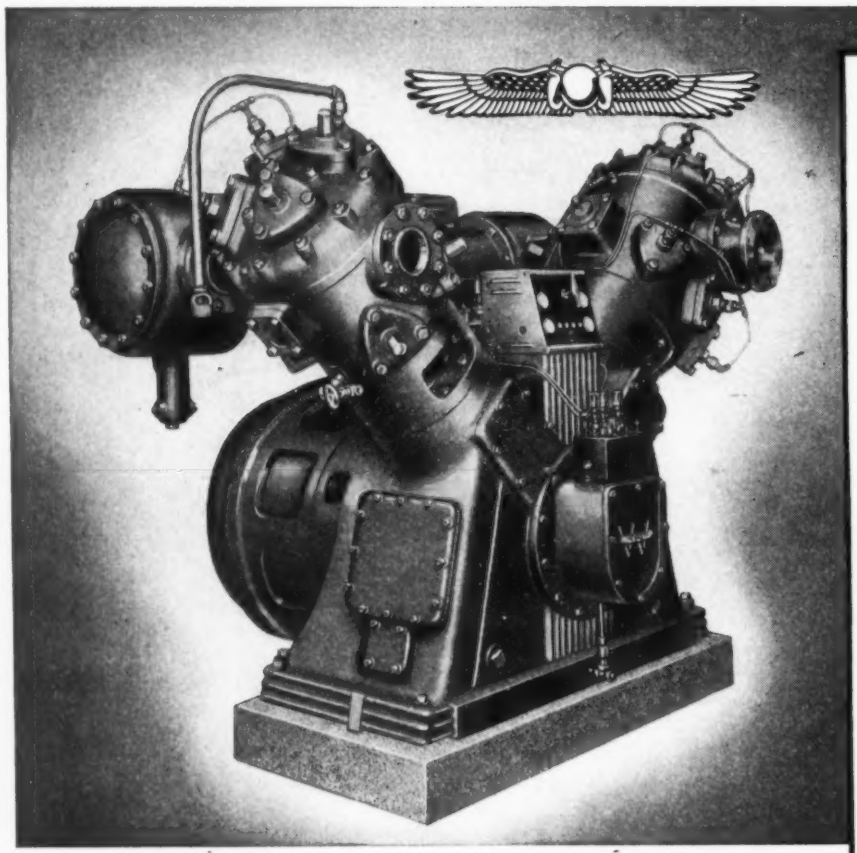
Diagram at left shows % Proportioneers % Adjust-O-Feeder automatic intermittent "shot feeding" of conditioning chemicals direct to boilers in accordance with feed water demand.

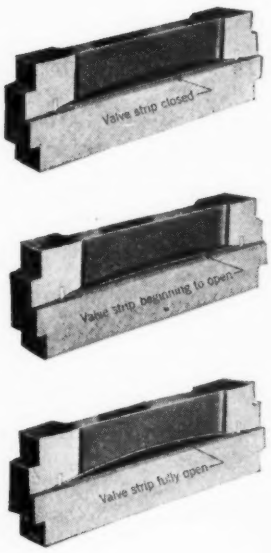
BULLETIN 1700 UPON REQUEST

% PROPORTIONEERS, INC. %

WRITE TO % PROPORTIONEERS, INC. % 16 CODDING ST., PROVIDENCE 1, RHODE ISLAND

NEW WORTHINGTON HUSKIE PACKAGED COMPRESSORS





The simplest, lightest, most efficient compressor valve ever made. A thin strip of steel seats by increasing contact from each end to the center. No springs, buffer plates or cushioning devices. Fits accurately even when valve seat is warped, and patented end inserts prevent pinching.

For Cooler Running . . . Trouble-Free Operation

Here's a lot of long-lived power, from 400 to 1350 cu. ft. per minute displacement, in a new streamlined "package" specially designed for trouble-free operation, low installation and maintenance costs.

In both 3 and 5-step models, variable capacity control results in the *cooler operation* of Worthington's new Y Angle Type Huskie Compressors. Cylinders are open to cool suction air at most stages of unloading.

Other Worthington "Outperformance" features include Feather Valves*— forced feed lubrication — filters for uninterrupted oil filtration, non-stop filter-cleaning. Write for more details. Describe your application.

WORTHINGTON PUMP AND MACHINERY CORPORATION
HARRISON, N. J.

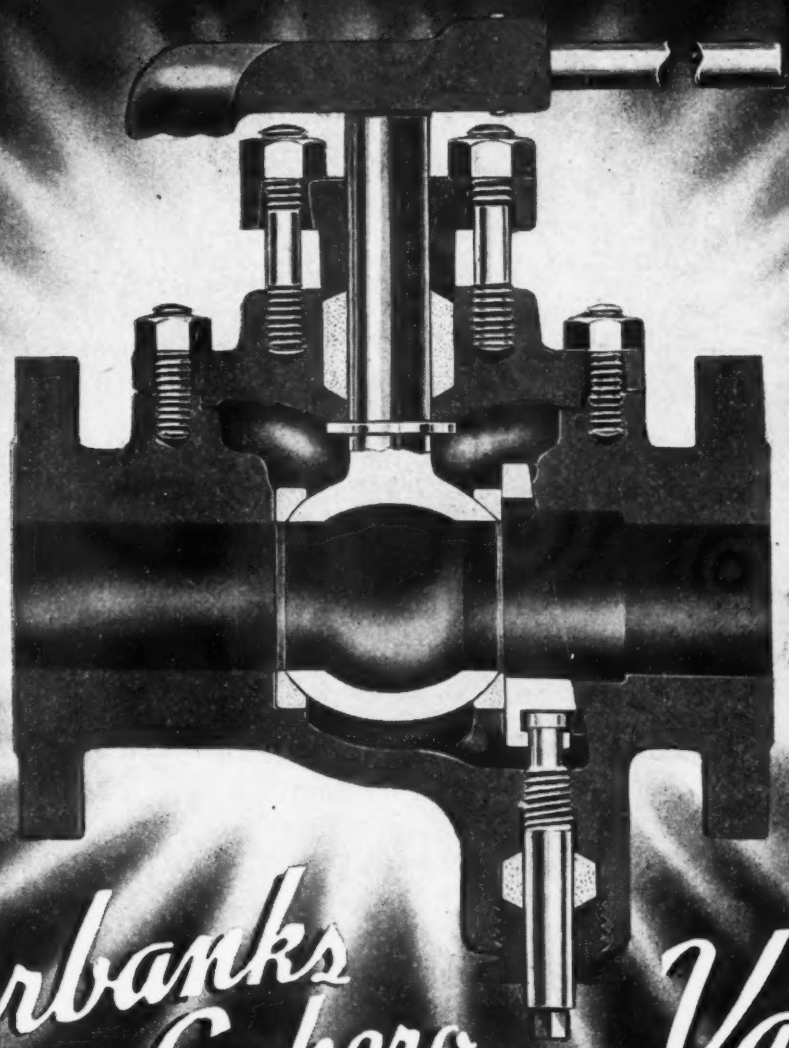
WORTH BEHIND THE NAME
WORTHINGTON

NO OTHER COMPRESSOR WILL OUTPERFORM A WORTHINGTON HUSKIE

Y Type . . . Horizontal . . . Vertical . . . Radial *Portable . . . Gas Engine Compressors . . . Vacuum Pumps*

*Reg. U. S. Pat. Off.

AC-4



Fairbanks Sphero Valves

End Blow-off Troubles

When a full-flow, quick-acting valve is required, specify "Fairbanks Sphero" patented valve.

Instead of the usual wedge or disc, a revolving ball is used which cuts through solids and liquids and wipes the seating surface clean. Can be opened or closed with a quarter turn of the lever handle.

Write for Catalog No. 42 and name of our nearest distributor.

THE FAIRBANKS COMPANY

393 Lafayette St., New York 3, N. Y.

Boston, Mass. Pittsburgh, Pa.

Plan Now For Power Conversion

American industry faces a tremendous task. The economic stability of the entire nation will depend upon industry's ability to convert from wartime operation to peacetime production with a minimum of time loss. Power is all-important in keeping the wheels of industry turning uninterrupted during that overlapping period of reconversion.

Power planning now is essential. Tomorrow's successful reconversion will depend upon the thoroughness of today's plans. Such planning requires competent, proven engineering. Theory must be combined with practice. To that end, J. F. Pritchard and Company Power Engineers are equipped and ready to assist with your particular problem. From the fundamental prime mover through the ultimate power use, Pritchard Power Engineers can design, engineer and construct your power plant. J. F. PRITCHARD & COMPANY, Power Division, Fidelity Building, Kansas City, Missouri.

KANSAS CITY
TULSA
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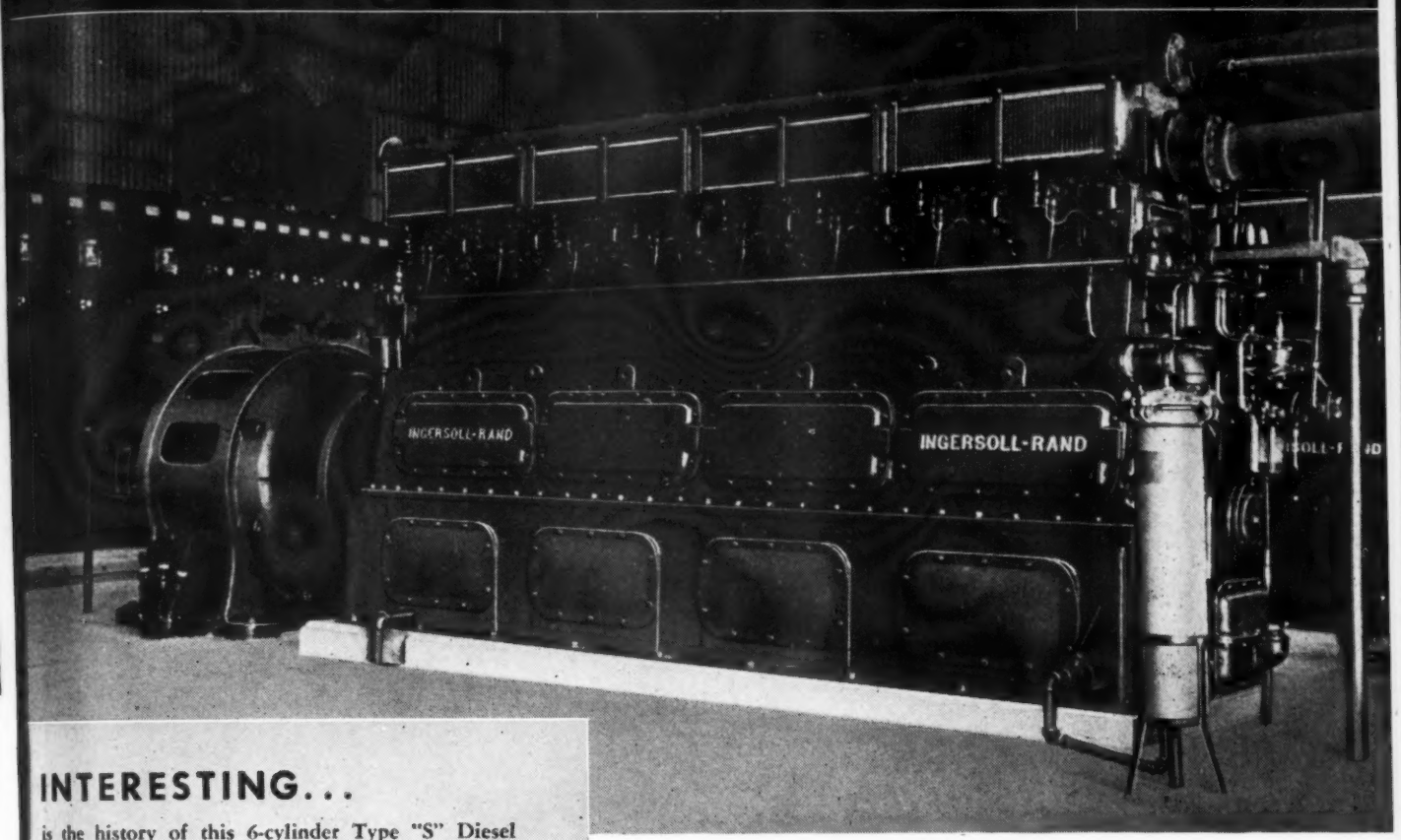
ENGINEERS AND CONSTRUCTORS
FOR THE CHEMICAL • PETROLEUM • GAS AND POWER INDUSTRIES
Manufacturers of Mechanical and Atmospheric Cooling Towers

HEAVY-DUTY Diesel Engine

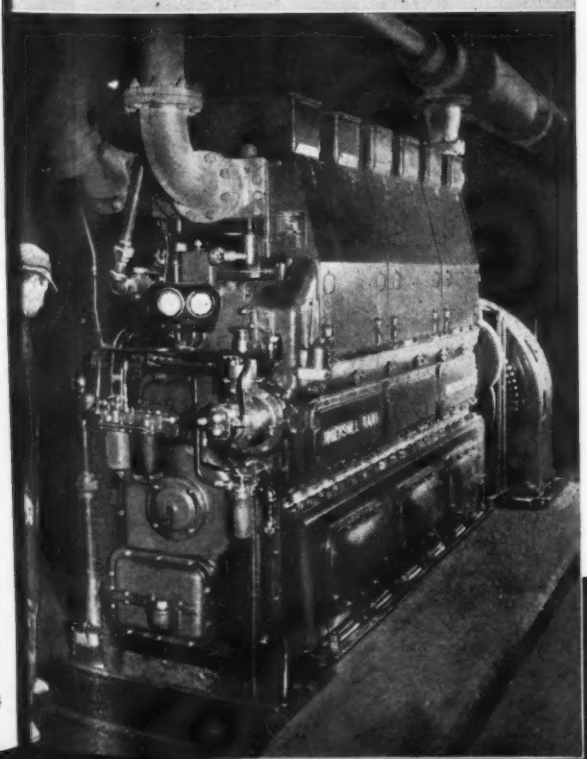


INTERESTING...

is the history of this 6-cylinder Type "S" Diesel Engine. In 1937 it was installed 9,000 feet above sea level in a Western metal mine. Since that time it has run almost continuously, 24 hours each day... generating all the electric power needed for the flotation mill.

Each September this engine is shut down for inspection and overhaul. It has never been stopped because of any mechanical failure.

The Type "S" is truly a **HEAVY-DUTY ENGINE.**



Two 8-cylinder Type "S" engines which supply power for the construction of a large dam in Mexico. A total of 12 I-R engines are used in this irrigation program.

The Ingersoll-Rand Type "S" is a continuous-service engine of compact design. It is of the 4-cycle, solid-injection type having complete force-feed lubrication and many other refinements normally found only in much larger engines.

The exceptionally low fuel consumption of less than 0.40 pounds per bhp-hr results in low overall power costs. In every respect, the Type "S" is the outstanding Diesel engine.

Engines of 3, 4, 5, 6, 7, and 8-cylinder sizes ranging from 225 to 600 hp are available. All sizes operate at 720 rpm.

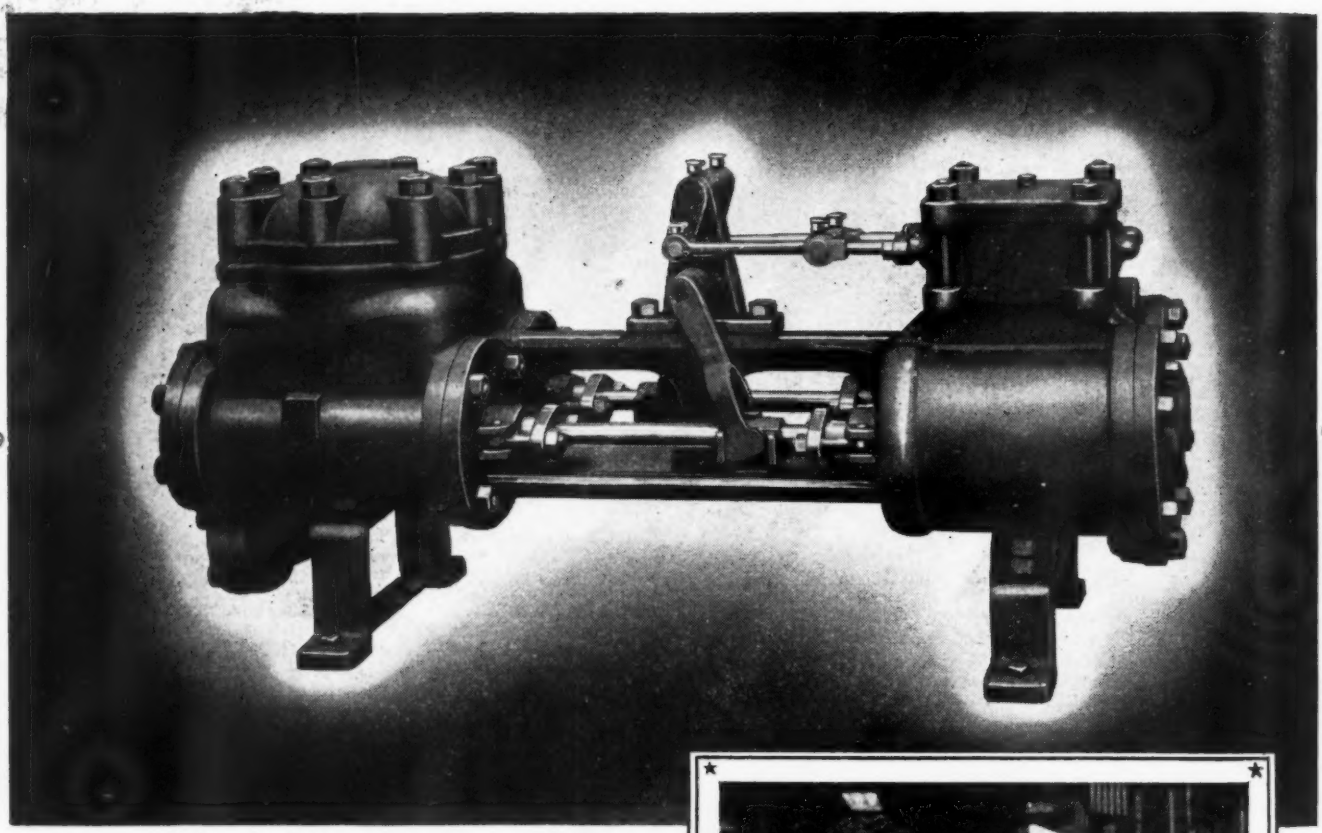
Let your local Ingersoll-Rand engineer give you more details about the Type "S". Perhaps he can help you to solve a power problem.

7-409

Ingersoll-Rand

11 BROADWAY, NEW YORK 4, N. Y.

A Pump With A Future That's Beginning Right NOW . . .



. . . Check The Features of This WARREN REALWEAR Horizontal Duplex Piston Pump

Here's good news for Industry . . and Post-war Planners! The Realwear Type of Warren Pumps are becoming available in standard sizes again in limited quantities for commercial uses.

Warren Realwear Horizontal Duplex Piston Pumps have made unusual endurance records, low maintenance records and operating efficiency records. Like all Warren Pumps they are "built to fit the job" . . . with no compromising with sound engineering and construction features. And as an added PLUS value, extra wear and corrosion resistance is **standard** with these Warren Realwear Pumps

Check over the following features of these pumps.

- One-piece type stainless steel piston rods
- Engine-type stuffing boxes, with glands held by swing bolts
- Renewable bronze bushings for valve gear links
- Multi-disc type pump valves of stainless steel
- Valve stems protected against wear by renewable bronze sleeves
- Centrifugally cast bronze cylinder liners

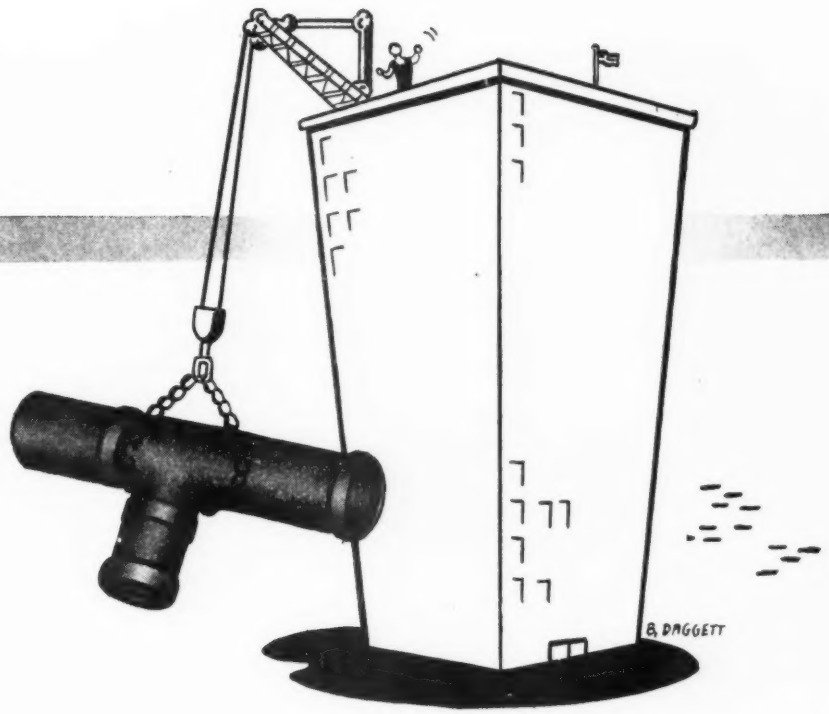
Investigate the Warren Realwear Pumps for **your** plant. Send for more information . or write for bulletin or Warren catalog.

WHEN OUR COUNTRY WAS ATTACKED our Navy . . Army . . . Merchant Marine and War Industries needed more and more Warren Pumps — and Warren has been "all-out" ever since. It is the pride that our skilled workers take in Warren Pumps that enable Warren Equipment to perform so faithfully under the do-or-die conditions of war production and battle. And it is this pride that enabled Warren Workers to win the Army-Navy "E" Award — at the presentation of which this picture was taken.

ARMY E NAVY

WARREN STEAM PUMP CO., INC.
WARREN, MASSACHUSETTS

PIPE DOWN!



Fabricating Heavy and Intricate Power Piping requires expert knowledge and appropriate equipment.

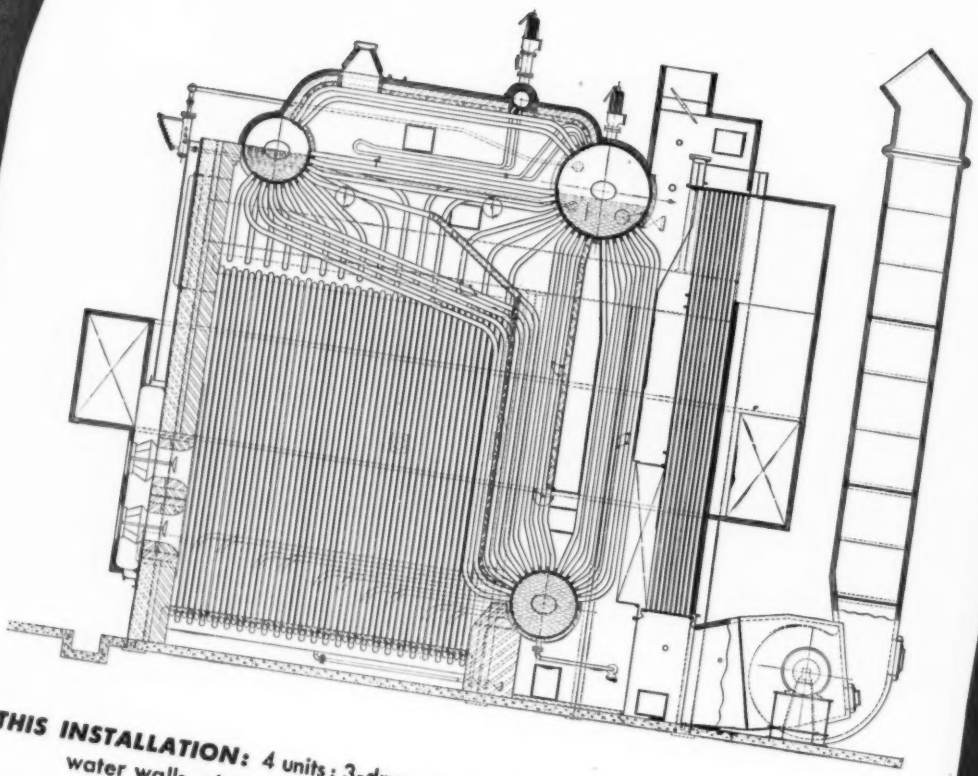
Cutting capacity up to 12 inch thickness is one of the numerous machines with which Flori is prepared to fabricate your needs.

MANY YEARS' experience enables us to offer uniformity of quality. Flori can help you to better Pipe Service.

FLORI PIPING

THE FLORI PIPE COMPANY, ST. LOUIS — CHICAGO

EDGE MOOR WATER TUBE BOILERS



THIS INSTALLATION: 4 units; 3-drum, radiant heat, bent tube, with superheater, water walls, air preheater; oil fired.

CAPACITY . . . . . 110,000 lbs. steam per hour.

DRUM PRESSURE . . . . . 275 lbs.

DEGREES OF SUPERHEAT 20

FINAL STEAM TEMPERATURE . . . 430° F.

2 of the 4 boilers comprising this installation have now been equipped with spreader stokers and dust collectors for conversion to coal firing.

- Edge Moor Boilers are designed for any required steam capacity and up to 900 lbs. drum pressure. Complete installation service is available, including superheater, water walls, economizers and air preheaters.

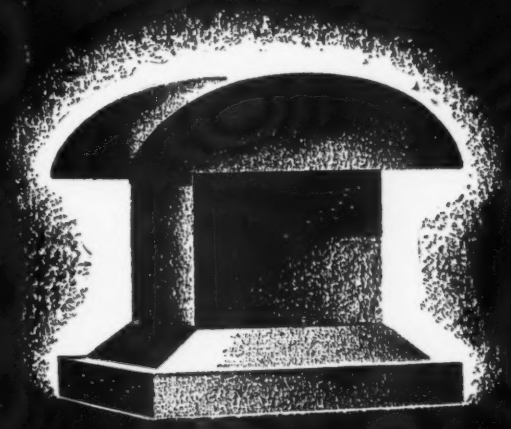
STEAM GENERATING EQUIPMENT

EDGE MOOR IRON WORKS, INC.

BRANCH OFFICES: NEW YORK 20, N. Y.: 30 ROCKEFELLER PLAZA
CHICAGO 2, ILL.: ONE NORTH LA SALLE STREET

MAIN OFFICE: EDGE MOOR, DELAWARE

PROBLEM: Moving 8,150,000 cubic feet of air a minute at a large war plant



SOLUTION: Installation of 733 Carrier Blackout Ventilators

MONUMENT to American engineering and construction genius is a war plant which builds engines for some of the airplanes that are now destroying Hitler's Fortress Europe.

Here as in other American war plants, a large number of Carrier Blackout Ventilators are in service; drawing in or exhausting an abundance of air throughout working areas. They move 8,150,000 cubic feet of air a minute. So carefully are they built, that no trace of light escapes from them when the plant is blacked out. Installed on the roof they require no floor space at all.

Carrier Blackout Ventilators for war plants are available in three types. *Exhaust ventilators* remove hot humid air from plant. *Supply ventilators* replace hot inside air with relatively cooler outdoor air, circulate it uniformly through working areas. *Tempering ventilators* warm the outside air as it is drawn in through the roof. All types are light in weight, require no protective housing or elaborate roof supports. Sturdily constructed of nonferrous panels; conserve critical materials. Keep out rain and snow. Designed for long, trouble-free service. Send now for descriptive literature—Carrier Blackout Ventilators may be the solution to your war plant ventilation problems.

CARRIER CORPORATION, Syracuse, N. Y.

Carrier

ARMY E NAVY

AIR CONDITIONING • REFRIGERATION
INDUSTRIAL HEATING

FORTY-TWO YEARS EXPERIENCE IN INDUSTRIAL INSTALLATIONS

SIX CARS OF BLENDED AVIATION OIL

...in one-eighth the time!

This is the story of another of those it-can't-be-done jobs that helped turn the tide of battle.

Wolf's Head Oil Refining Company, Oil City, Pa., got an emergency order for six cars of Navy aviation oil, a special blend that must pass rigid laboratory tests. It was a job that would, under ordinary methods, have taken over 40 hours.

With a Bowser Proportioner, pumping directly into the tank cars, the work was finished in an elapsed time of a few minutes over *five hours*. And all tests showed perfect blending.

This Bowser Proportioner blends the many different grades of oil produced by this oil company . . . and works with almost unbelievable speed and accuracy. Speed? It blends up to 175 gallons a minute (which is in excess of the rating specified by Wolf's Head). Accuracy? Some of the proportions call for a single pint of one ingredient to 100 gallons of finished blend . . . one part in 800 . . . yet every test is "right on the nose."

That's typical Bowser Liquid Control.

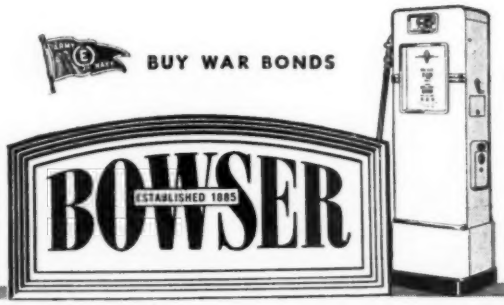
Other phases of Bowser Liquid Control—oil filtration, turbine oil conditioning, force feed lubrication—are giving equally outstanding performance in public utility and industrial power plants throughout the country.

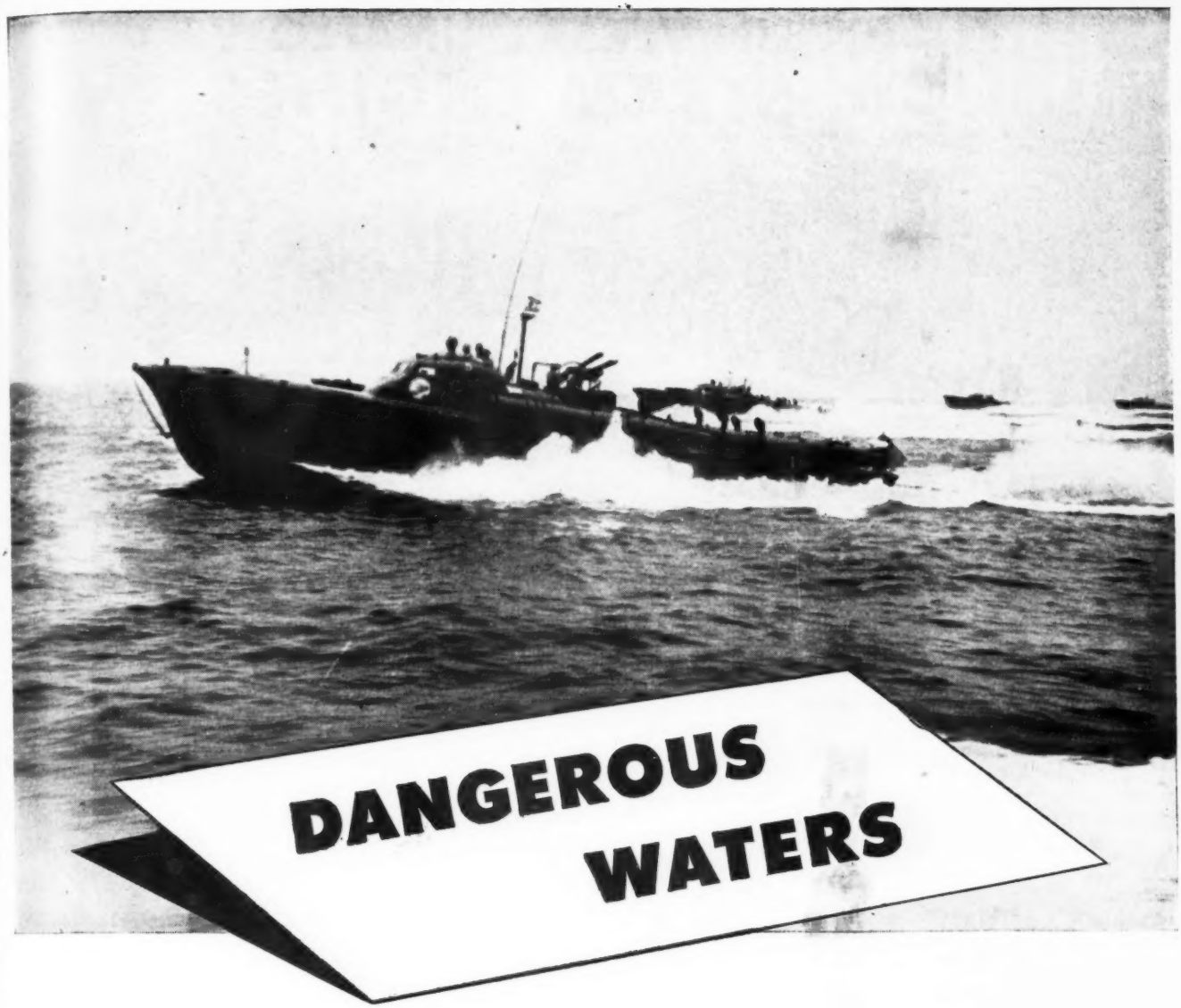
Bowser Turbine Oil Conditioners, for example, are serving in many of America's leading steel mills and paper mills throughout the country in which it is vitally important to eliminate acids which cause emulsions, corrosion and plugging of oil tubes.

Whatever type of liquid control equipment you require, here's an important point to remember —wherever you are, there's a complete Bowser service organization conveniently close to you. BOWSER, INC., Fort Wayne 5, Indiana.

THE NAME THAT MEANS **EXACT CONTROL** *OF LIQUIDS*

BUY WAR BONDS





● The best defense is a well organized offense . . . whether waging a war in dangerous waters or fighting water problems in industrial production.

Water . . . unconditioned . . . when carried to vital spots in your plant, can waste fuel, increase labor costs, ruin vital equipment and wreck production schedules.

Today, effective water conditioning is a "must" in the battle against scale, corrosion, embrittlement, oil, etc.

You are invited to call on Infilco's Engineering staff to help in any problem of boiler or evaporator feedwater treatment, cooling water conditioning, condensate oil removal, steam purification, trade waste treatment, etc.

INFILCO
INCORPORATED

325 W. 25TH PLACE, CHICAGO, ILL.

INFILCO

ACCELATOR SOFTENERS • CHEMICAL FEEDERS • PROPORTIONERS
WATER FILTERS • CLARIFIERS • COOLING WATER CONDITIONERS
CONDENSATE FILTERS • STEAM PURIFIERS • HOT-FLOW SOFTENERS
LIME-SODA SOFTENERS • ZEOLITE SOFTENERS • CATEXERS

ARMY NAVY

SKINNER "UNIVERSAL UNAFLOW" STEAM ENGINES

In the MODEL Power Plant OF UNITED STATES TOBACCO CO.

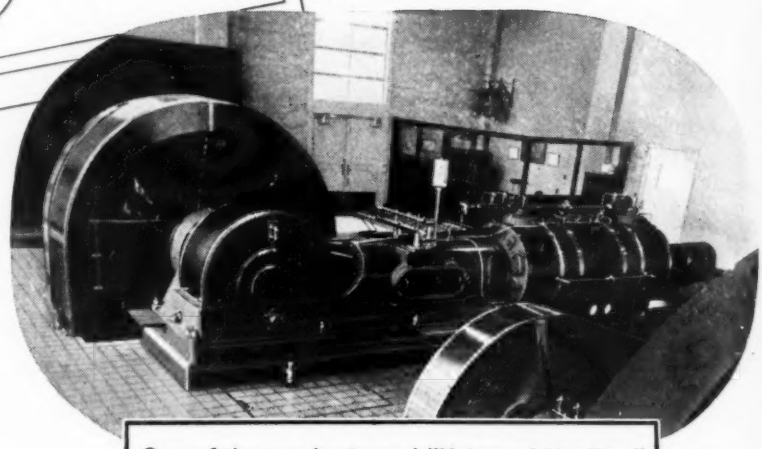
IT took efficiency (and that's a mild word for it) to pack all the satisfaction that's found in MODEL tobacco into a ten-cent package. It took efficiency in sales promotion to build that package into a position of national leadership.

The same kind of efficiency, from roof to cellar, went into the planning of the handsome, modernistic MODEL factory at Richmond, Virginia. All of the power equipment for this plant was selected after considering the most economical operation on the basis of heat, light and power costs, with the maximum use of exhaust steam for process.

The outstanding performance of a Skinner "Universal Unaflow" engine-generator unit in the Chicago plant of the United States Tobacco Co., and the selection of two of these engines for its new factory at Nashville, Tennessee, made "Universal Unaflow" engines the logical choice for Richmond.

The high economy of the "Universal Unaflow" engine is permanent—maintained throughout the life of the engine by the use of steam-tight poppet valves, an exclusive Skinner feature.

More than 2,000 power users, in industries and institutions of various types, have found it more economical to generate their electric power with Skinner "Universal Unaflow" Steam Engines.



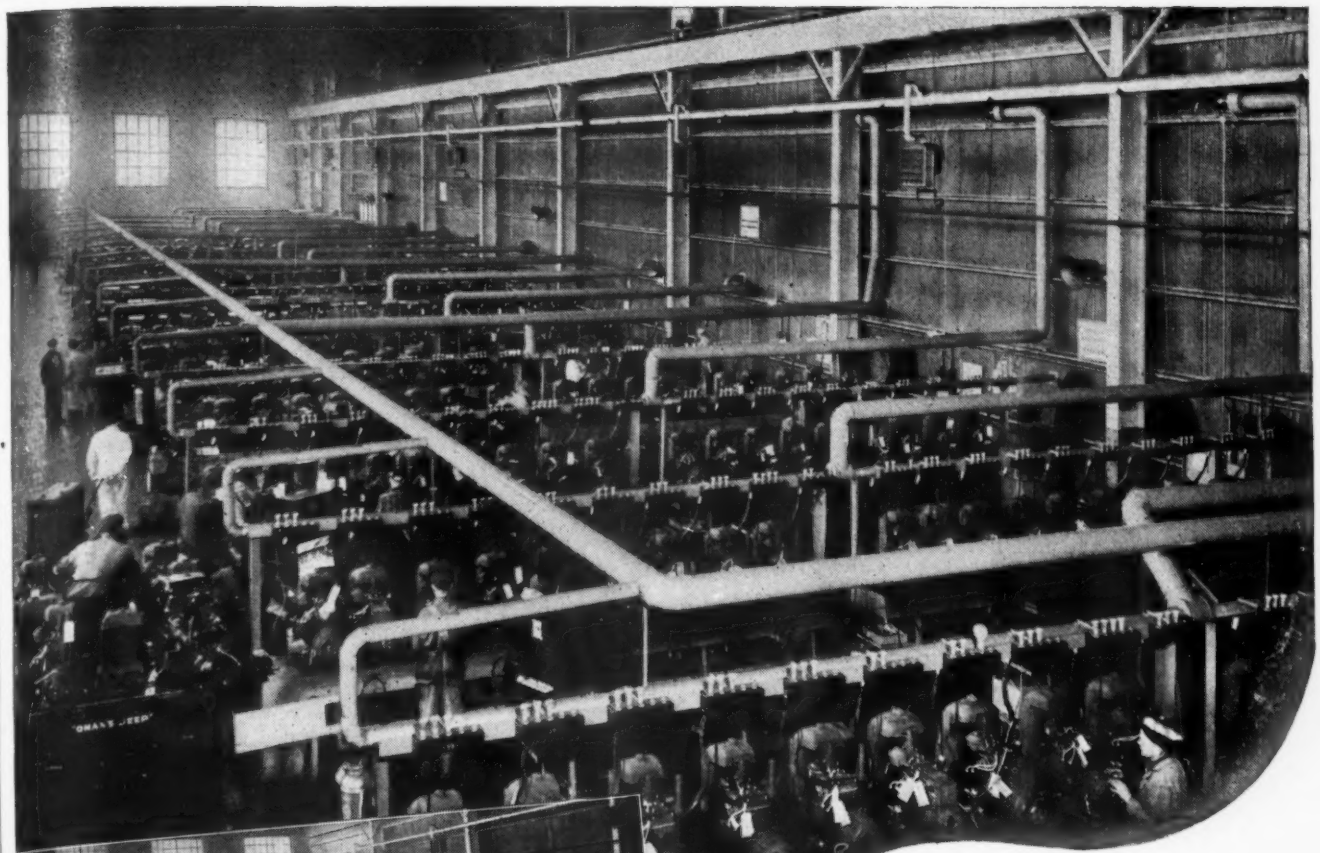
One of the two horizontal "Universal Unaflow" engines driving 500 kv.a. generators in the MODEL TOBACCO plant at Richmond

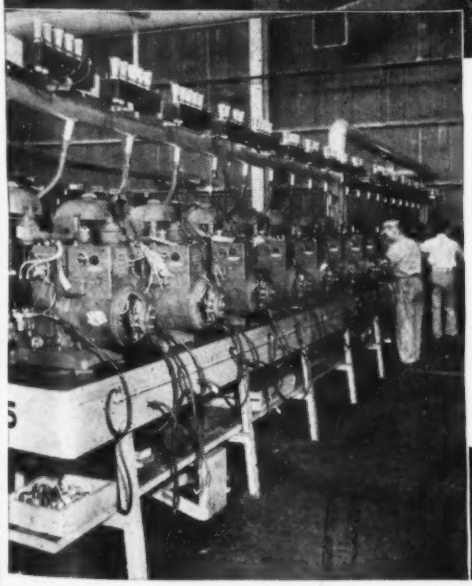
SCHMIDT, GARDEN & ERIKSON, ARCHITECTS, CHICAGO

Let's All Back The Attack—Buy More War Bonds

For Over 75 Years, Doing One Thing Well—Building Steam Engines

SKINNER ENGINE COMPANY, ERIE, PA.





Here is One of Many Problems PENFLEX *Has Helped to Solve . . .*

Illustrated, Onan Generators on test in world's largest test rooms.

The Onan plant was one of the first to solve the problem of exhaust heat. They installed PENFLEX Flexible Metallic Exhaust Pipes to convey exhaust heat from generators on test to main distribution system where it is routed to other operations and re-used. A PENFLEX Flexible Metallic Exhaust is packed with each generator to be used wherever Onan sets are found.

Four-wall interlocking joint construction, flexibility, and insulation against vibration make PENFLEX suitable for such a job.

PENFLEX Flexible, All-Metal Hose or Tubing is also available for bilge ventilation, dust collection, coolant conveying, vibration isolation, hydraulic and air controls and many other applications.

Perhaps you, too, have a similar problem. If so, our Engineering Department will help you solve it.

PHOTOS COURTESY D. W. ONAN

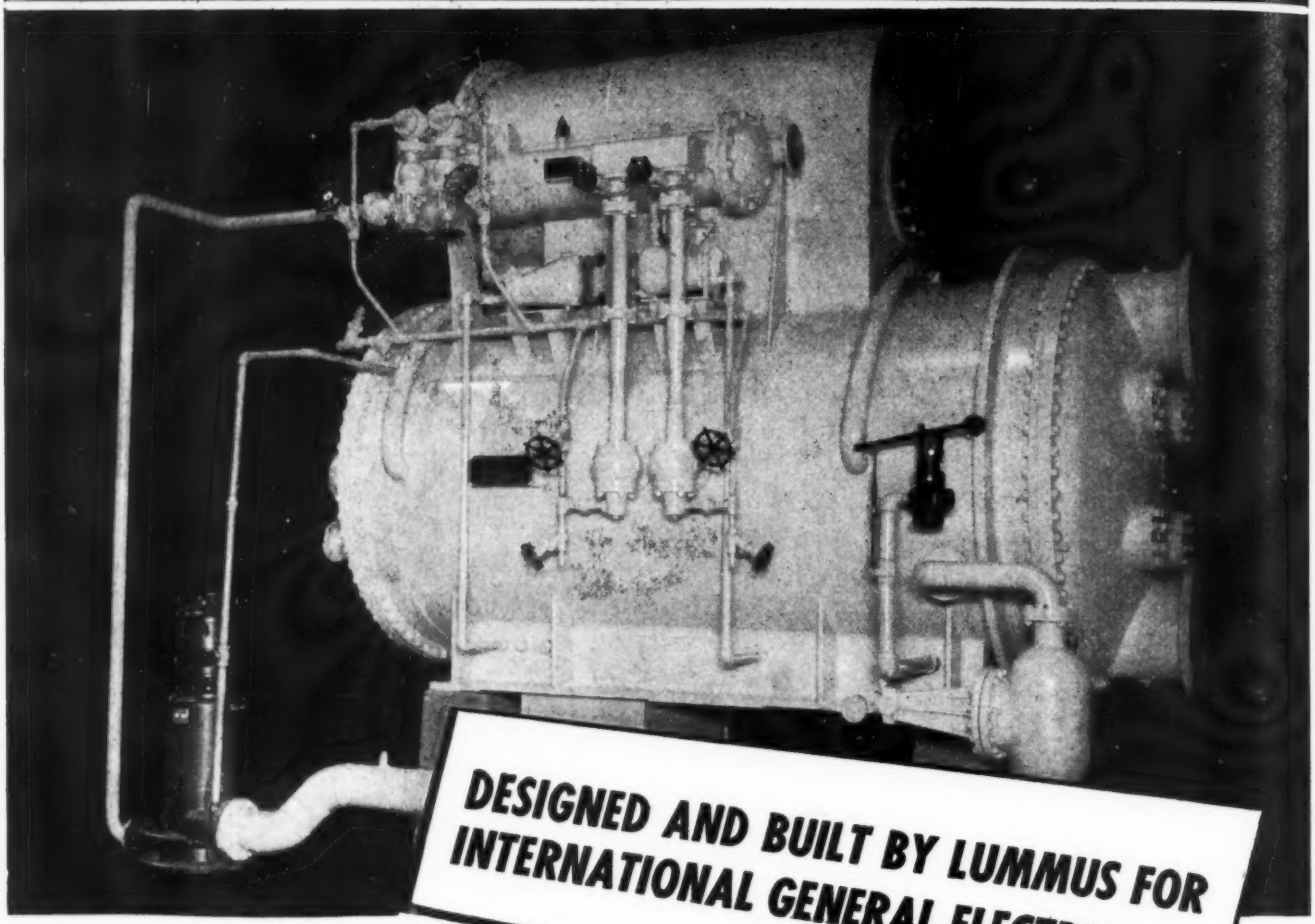
PENFLEX METAL HOSE

PENNSYLVANIA FLEXIBLE METALLIC TUBING CO.

7238 Powers Lane, Philadelphia 42, Pa.

ESTABLISHED 1902

3,000 kw package type surface condenser



DESIGNED AND BUILT BY LUMMUS FOR INTERNATIONAL GENERAL ELECTRIC CO.

Shipped complete . . . ready for installation on a mobile power train . . . this 3,000 kw package type surface condenser is one of forty designed and built by Lummus for the International General Electric Company.

Among the interesting features of design and construction are . . . tube sheets welded to the shell of the condenser, eliminating two packed joints (sources of possible air leakage) . . . complete deaeration of condensate in the hot well through the introduction of exhaust steam in the deaerating system . . . air ejector set, designed and built by Lummus is an integral part of the package unit.

Lummus designs and builds a complete line of surface condensers and other heat exchange equipment for stationary, marine, and refinery applications. Write for complete data.

Lummus Power Plant Equipment

- Surface Condensers
- Steam Jet Air Ejectors
- Bleeder Heaters
- Boiler Blowdown Heat Exchangers
- Evaporators
- Fuel Oil Heaters
- Lubricating Oil Coolers

THE LUMMUS COMPANY • 420 LEXINGTON AVE., NEW YORK 17, N. Y.

LUMMUS

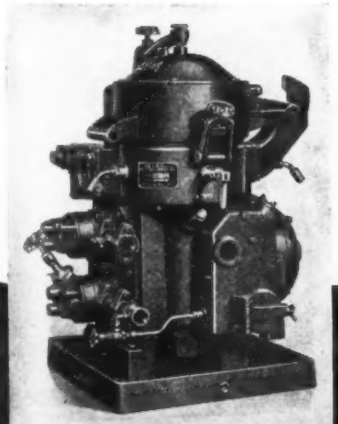
PURIFIED LUBRICATING OIL

TIME was when the old water wheel supplied power and little thought was given to lubrication. Today's turbines and engines, however, not only demand lubricating oil refined to exacting specifications; they also require that the highly refined oil be kept free from impurities which would impair its lubricating efficiency. De Laval Centrifugal Purifiers provide the most positive means of maintaining the oil in proper condition.

De Laval Oil Purifiers utilize centrifugal force to remove instantaneously the impurities normally collected in service—water, sludge, dirt, and other foreign matter. The De Laval disc type bowl so completely removes these impurities that the constantly purified oil performs at full efficiency over an indefinite period.

Bearings and other vital engine parts are given utmost protection and more dependable power plant operation is secured.

Write for additional details, sent without obligation.



THE DE LAVAL SEPARATOR COMPANY
165 Broadway, New York 6 — 427 Randolph St., Chicago 6
DE LAVAL PAC FIC CO., 61 Beale St., San Francisco 19
THE DE LAVAL COMPANY, Limited
MONTREAL — PETERBOROUGH — WINNIPEG — VANCOUVER

DE LAVAL OIL PURIFIERS

VEELOS

THE ADJUSTABLE V-BELT

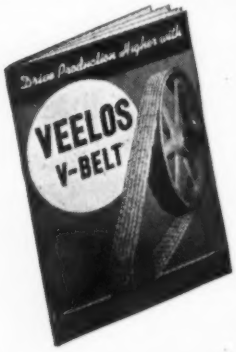
Ends Interruption with Link Construction!

WITH these Cooper-Bessemer engines, *uninterrupted* service is essential. They can't let up on their job of driving water pumps handling 25,000 g.p.m. at the Port Neches Butane Products Plant—largest synthetic rubber plant in the world.

That's why Cooper-Bessemer chose Veelos V-belt drives for these engines. Cooper-Bessemer engineers know that Veelos promotes continuous, efficient operation . . . solves power transmission problems because of these Veelos link construction features:

1. Quick replacement . . . no tear down. Belts can be installed, repaired, or replaced in a minimum of time and without disassembly of bearings or shaft.

2. Controlled tension protects bearings and belts. Control of tension on each individual strand provides uniform, controlled tension throughout *the entire drive.* This protects bearings as well as belts.



3. You design the drive layout . . . you install the belt. Veelos drives can be made any desired length. Drive layout and engine or machine design are simplified.

Free 8-page illustrated manual gives Veelos applications, construction detail, installation directions and engineering data. Write for your copy today—and keep it where everybody concerned with belt drives can easily refer to it.

MANHEIM MANUFACTURING & BELTING CO.

200 MANBEL ST., MANHEIM, PENNSYLVANIA

Link Construction Ups Production

VEELOS

THE LINK

V-BELT

ADJUSTABLE TO ANY LENGTH

ADAPTABLE TO ANY DRIVE

PRODUCING KILOWATTS ECONOMICALLY

Generator output in many electric plants proves Enterprise Diesel Engine superiority in maintaining high levels of kilowatt production. Built for wide industrial use, Enterprise 4-cycle Diesels are constructed for individual purposes, 225 HP to 2100 HP in three essential sizes, each of which is built in 6 or 8 cylinders. Exhaust gas Turbo-charging provides the higher outputs with exceptional low fuel economy.

Since 1886 Enterprise has engineered meritable equipment for industry

Direct connected, geared or belted to equipment, Enterprise Diesels burn heavy fuel oils with unusual economy. Advanced engineering, embodying wear resistant metals and positive lubrication, results in sustained operation for long continued periods without maintenance or overhaul. Full engine enclosure seals out abrasive dust and grit. Hydraulic Governors provide regulation to meet individual generator requirements.

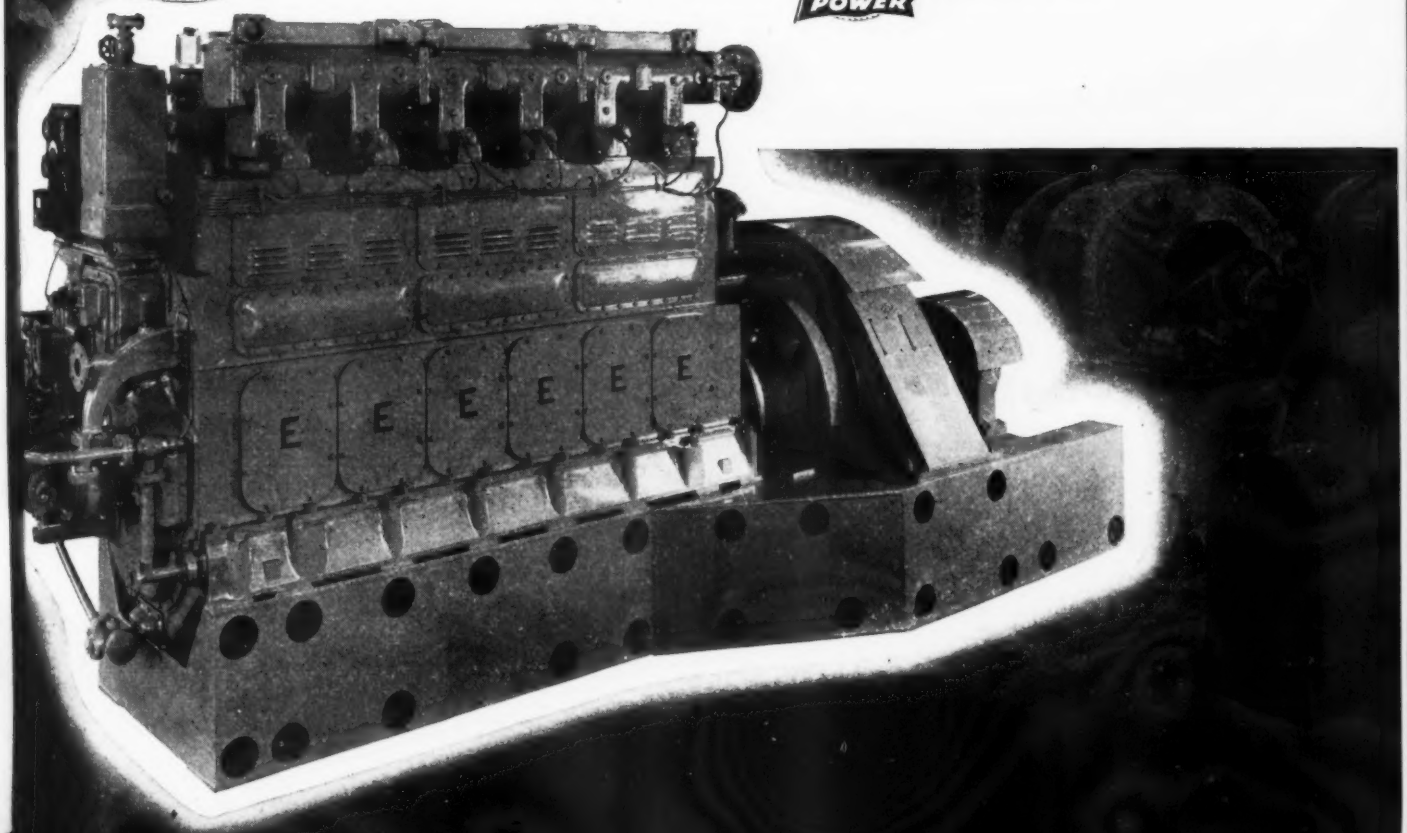
New Illustrated Catalog No. 192 of late models gladly sent on request

ENTERPRISE ENGINE & FOUNDRY CO.

SAN FRANCISCO
SEATTLE

Enterprise DIESEL POWER

WASHINGTON, D. C.
NEW YORK



Cooling Tower DOs and DON'Ts

—by MARLEY (No. 2 of a series)

SYSTEMATIC INSPECTION

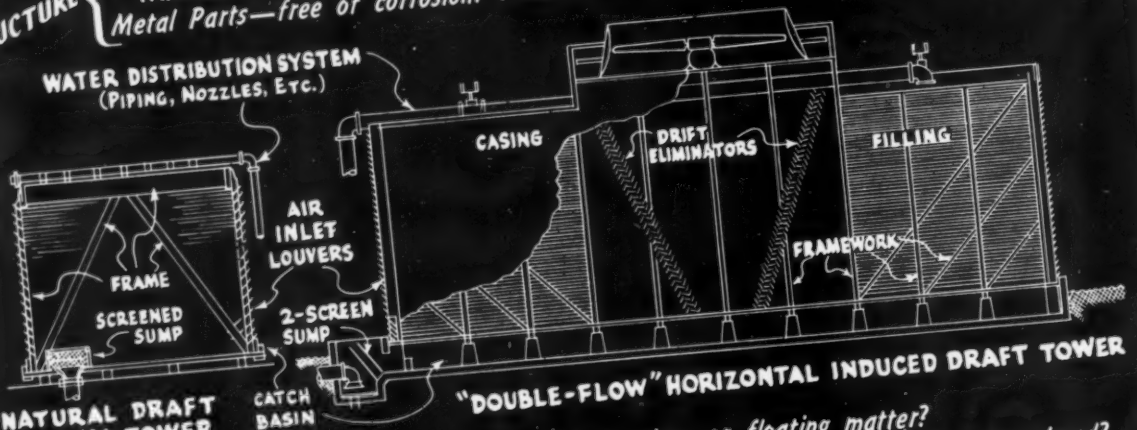
Maintenance time and expense can be minimized and all but routine repairs and shut-downs can be avoided by careful regular inspection. A definite and frequent schedule should be observed —daily for large mechanical draft towers, weekly for small natural draft types.

A thorough monthly check-up should answer these questions:

WATER DISTRIBUTION SYSTEM
- Supply Piping and Headers—free of obstructions and leaks?
- Regulating Valves—operate freely when tested?
- Nozzles or other Outlet Orifices—all function uniformly?
- Water Pressure—equal over entire system? (In pipe-and-nozzle systems all branches must show even spray. In gravity-flow systems all flumes, launders or basins must be true and level so water is same depth in all boxes.)

AIR PASSAGES
- Air Inlet Louvers—unobstructed, none sagging or out of place?
- Filling (Decks) and Drift Eliminators—free of obstructions, algea or scale?

STRUCTURE
- Bolts of Frame and Casing—tight? (In wood towers, must permit expansion and contraction. Find cause of casing leaks, frame stress, etc., such as foundation settling.)
- Metal Parts—free of corrosion? Paint needed? (Examine steel towers closely.)



CATCH BASIN
- Basin Water—clean and free of debris, algea or floating matter?
- Float Valve (if one is used on make-up)—work freely? Not leak when closed?
- Sump Screens—in place and clean? Safety Overflow—open and unobstructed?
- Floor and Sidewalls—free of leaks? (In concrete, examine expansion joints. In wood basins dried out during idleness, small leaks close as wood becomes soaked.)

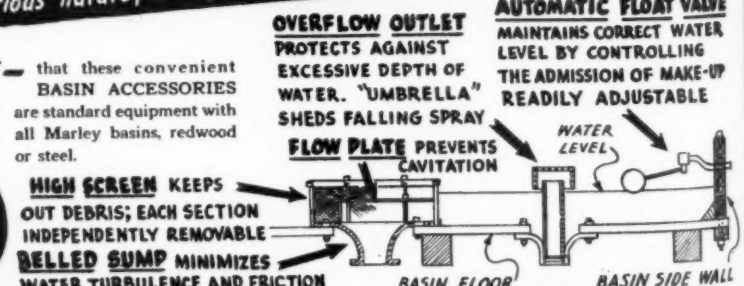
MECHANICAL PARTS
- Metal Parts—clean, well-painted, free of corrosion?
- Fans—rotate freely? In balance? Blade clamps and hub bolts tight?
- Reduction Gears—properly lubricated, operating quietly? No oil leaks? (Slight "play" in gears is normal but, if excessive, indicates wear.)
- Drive Shafts—in alignment and balance? Coupling bolts tight? Guards secure? Universal joints properly lubricated? Motors—properly greased? Not over-heating?

The inspector should report matters requiring attention to the maintenance or operating crew; if of an unusual or serious nature, notify the manufacturer.

MARLEY COOLING TOWERS

24-A

DO YOU KNOW— that these convenient BASIN ACCESSORIES are standard equipment with all Marley basins, redwood or steel.


OVERFLOW OUTLET PROTECTS AGAINST EXCESSIVE DEPTH OF WATER. "UMBRELLA" SHEDS FALLING SPRAY
AUTOMATIC FLOAT VALVE MAINTAINS CORRECT WATER LEVEL BY CONTROLLING THE ADMISSION OF MAKE-UP READILY ADJUSTABLE
WATER LEVEL
FLOW PLATE PREVENTS CAVITATION
HIGH SCREEN KEEPS OUT DEBRIS; EACH SECTION INDEPENDENTLY REMOVABLE
BELLED SUMP MINIMIZES WATER TURBULENCE AND FRICTION
BASIN FLOOR
BASIN SIDE WALL

THE MARLEY COMPANY, INC. · KANSAS CITY · KANSAS

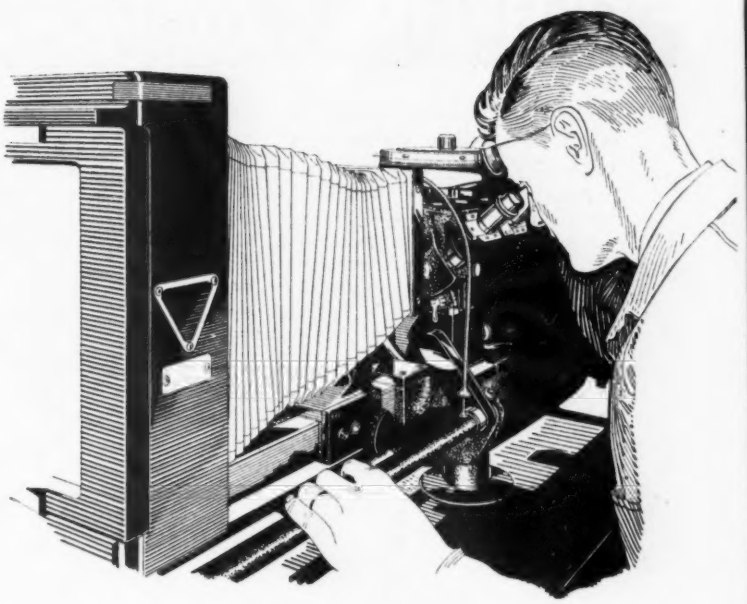
SCIENTIFIC CONTROL OF WELDING PROCEDURE

at

Pittsburgh Piping and Equipment Company

assures

SAFER HIGH TEMPERATURE HIGH PRESSURE PIPING



Photomicrography plays important part in control of welding procedure.

WITH modern steam generating systems calling for higher pressures and increased temperatures, the importance of welding, in pipe fabrication cannot be over emphasized.

At Pittsburgh Piping, all welding procedure and welders' qualification tests for high pressure, high temperature piping are made in strict compliance with various codes and specifications, (A.S.M.E. Power Boiler Code, A.S.A. Power Piping Code, etc.), under the direct supervision and control of our metallurgical laboratory. Examination of welds on pre-fabricated assemblies is conducted in the shop as work progresses. In the laboratory are necessary modern facilities for the preparation, examination, heat treatment, and photomicrography of metallurgical specimens.

Such scientific laboratory control of welding eliminates guesswork, and guarantees better, safer piping fabrication.

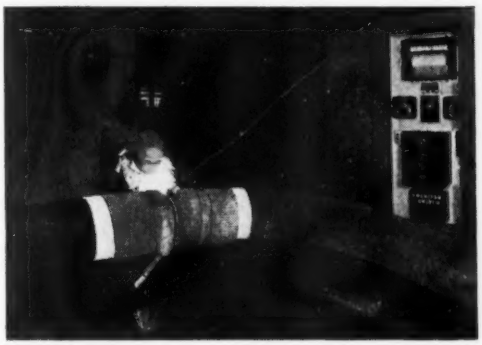


Illustration shows a qualified welder joining a 14" carbon-molybdenum pipe to a plain bend of similar specification. Areas adjacent to the weld are electrically pre-heated to 400°F minimum and maintained during entire welding operation. Weld is then stress relieved by similar method. Note temperature indicating and control instruments at right, which automatically maintain temperature within ± 10°F for any desired range.

Carbon-molybdenum weld test samples made for laboratory analysis and test, conclusive proof that weld metal is as ductile as, and actually stronger than the original metal.

Buy More War Bonds

Pittsburgh Piping

AND EQUIPMENT COMPANY

10 Forty-Third Street—Pittsburgh, Penna.

Woolworth Building, New York
Occidental Building, Indianapolis
Book Tower, Detroit
Peoples Gas Building, Chicago
Public Square Building, Cleveland
10 High Street, Boston
525 Market Street, San Francisco

The AIR in Your Plant—DOES IT HELP OR HINDER?

Neither manpower nor machines can do a 100% production job, unless the air is clean, pure and correctly temperatured.

Are you letting production lag and costs mount because you haven't the necessary air handling and conditioning equipment?

Thousands of plants turn such problems over to Clarage. We have developed, through more than a quarter-century of experience, the proper equipment for any application.

And we have offices in key cities to give you expert, first-hand assistance. Write or 'phone us about your requirements.

COOLING, HEATING, HUMIDITY CONTROL

Floor type unit shown above; space-saving, suspended type at left.

NO INSTALLATION DELAYS—"Whole Works" in One Assembly

Step up your war production and insure lower post-war costs by maintaining the RIGHT atmospheric conditions. Clarage Multitherm (air conditioning) Units reduce this vital job to simplest form — low first cost; quickly installed without expensive building alterations; no ducts required.

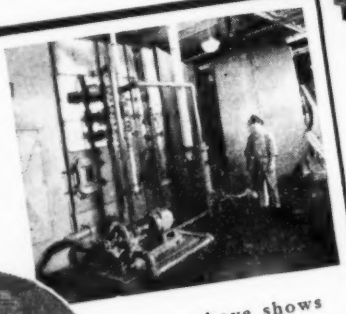
Units are available for cooling only, heating only, or complete, year-round control of temperature and humidity. Sizes to meet every need.

✓ CUT YOUR COSTS

✓ SPEED PRODUCTION

✓ DECREASE ABSENTEEISM

FRESH AIR Ventilation for Large Areas



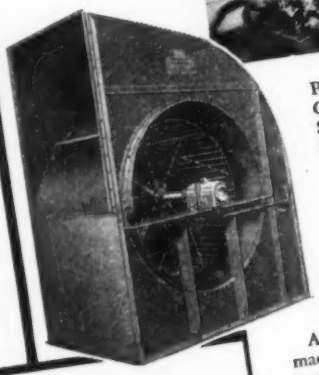
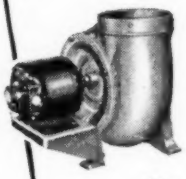


Photo above shows Clarage Ventilating System serving large industrial plant — fan at right; air washing and cleaning equipment at left.

Fans are built in 28 sizes; 500 to 100,000 c.f.m.—slow speed for belt drive; high speed for direct motor drive.

Air washers are "tailor-made" to meet individual service conditions.



READY UNITS for Small Space Ventilating

Here are ideal units for ventilating small factory or office areas — removing fumes and odors from laboratories, etc. The most complete line of small ventilating blowers on the market; 13 sizes with capacities 200 to 700 c.f.m. Most sizes can be operated from lighting circuit.

Built for long service without any attention except motor bearing lubrication.

Removing Dusts, Fumes, Smoke, Noxious Gases

—and for Pneumatic Conveying

Clarage Exhaust Fans are made to cover all kinds of exhaust and blow pipe needs — carrying away gritty, injurious dusts from emery and buffing wheels, fumes from chemical processes and paint spray operations — used wherever an industrial plant must be rid of atmospheric pollution.

As in all other Clarage Fans, wheels are both statically and dynamically balanced. Dust-proof, oil-tight bearings standard equipment. Large range of sizes.

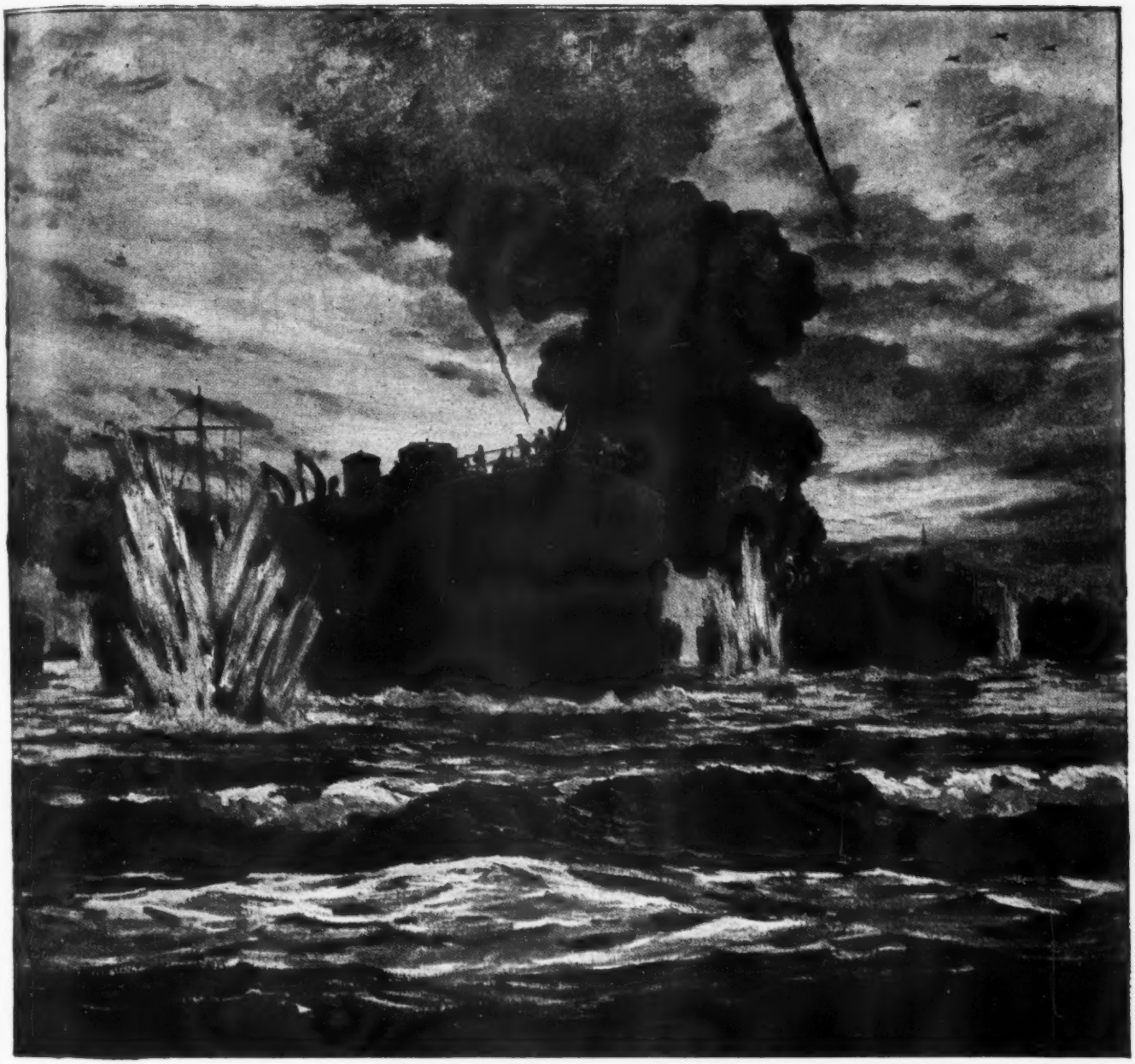
How to Buy CLARAGE EQUIPMENT in War-Time

We are able to furnish any industrial plant with practically any type of Clarage product, providing the order carries a priority rating of AA-5 or better. ***Deliveries on most Clarage equipment can be made promptly.***

COMPLETE AIR CONDITIONING
•
COOLING
•
VENTILATION
•
FACTORY HEATING
•
MECHANICAL DRAFT
•
FANS and BLOWERS for INDUSTRIAL NEEDS

Clarage Fan Company Kalamazoo, Mich.

APPLICATION ENGINEERING OFFICES IN ALL PRINCIPAL CITIES



AVAILABLE ON REQUEST . . . Handsome full-color 10" x 10" reproduction of this dramatic painting of the "Green Dragons" by Lt. Commander Anton Otto Fischer, the internationally famous marine painter. No advertising matter.

When the Green Dragons Strike

Fearfully and wonderfully made are the LST's—Landing Ships, Tanks—the "Green Dragons" of the Allied Invasion Forces. When their prows touch the enemy beaches giant jaws gape open and spew forth a small mechanized army—tanks, mobile artillery, heavily armed fighting men. Another beach head is established, to have and to hold! Aboard ship, unfailing ventilating systems are required to remove the poisonous exhaust gases of warming up motors in the cavernous tank deck. Accordingly every LST is equipped with high speed blowers, driven by Star Electric Motors. So much power is packed into each motor that two alone will ventilate the hull, giving a wide margin of safety needed in ships that face the full force of enemy bombing and shell fire. Also, aboard each LST there's a Star gear motor to operate the elevator—to lift or lower fighting tanks and trucks. At sea or in industry—"in the tight spots, it's a STAR."

STAR ELECTRIC MOTOR COMPANY, BLOOMFIELD, N. J.

STAR MOTORS

POWER PACKAGED AS YOU NEED IT

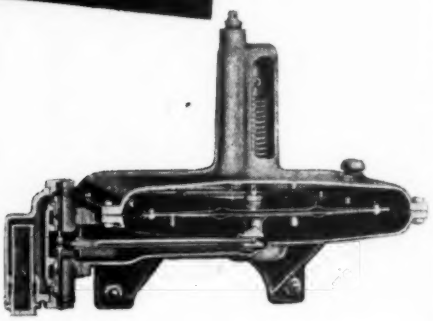
GREATER ECONOMY ALL THE WAY WITH MORE STEAM FROM LESS FUEL . . . .

CASH STANDARD AUTOMATIC COMBUSTION CONTROL SYSTEMS

FURNACE DRAFT CONTROLLER

. . . regulates the boiler up-take damper

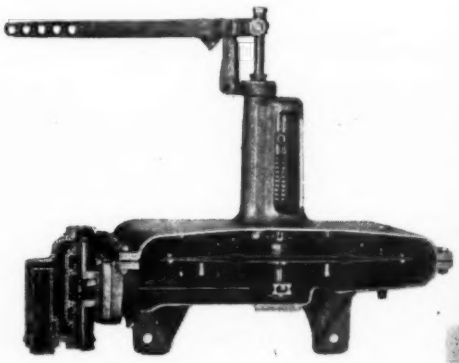
This CASH STANDARD Furnace Draft Controller (which comes complete with Operating Power Cylinder) works from over-fire draft, regulating the boiler up-take damper to maintain a constant draft in the combustion chamber. Place it near up-take damper. It works independently of either of the two Controllers shown below. It does its part toward money saving by eliminating wasteful air infiltration.



AIR FLOW CONTROLLER

. . . meters the air needed for combustion

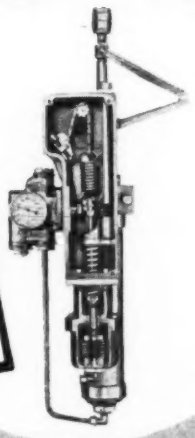
This CASH STANDARD Air Flow Controller meters the air needed for combustion. Install it near its damper. It is not affected by changes in fuel bed resistance or any other variables because it meters air supply according to the differential pressure through the gas passages of the boiler, doing its part to insure perfect combustion. Comes with Operating Power Cylinder.



FUEL FEED CONTROLLER

. . . adjusts the rate of combustion

This CASH STANDARD Master Controller automatically regulates fuel feed. Locate it conveniently. Working from boiler pressure, it will adjust the rate of combustion by regulating the rate at which fuel (any kind of fuel) is supplied to the boiler furnace. And it will adjust the Air Flow Controller so the correct amount of air is supplied for proper combustion—hence, money saving. Comes with Operating Power Cylinder.

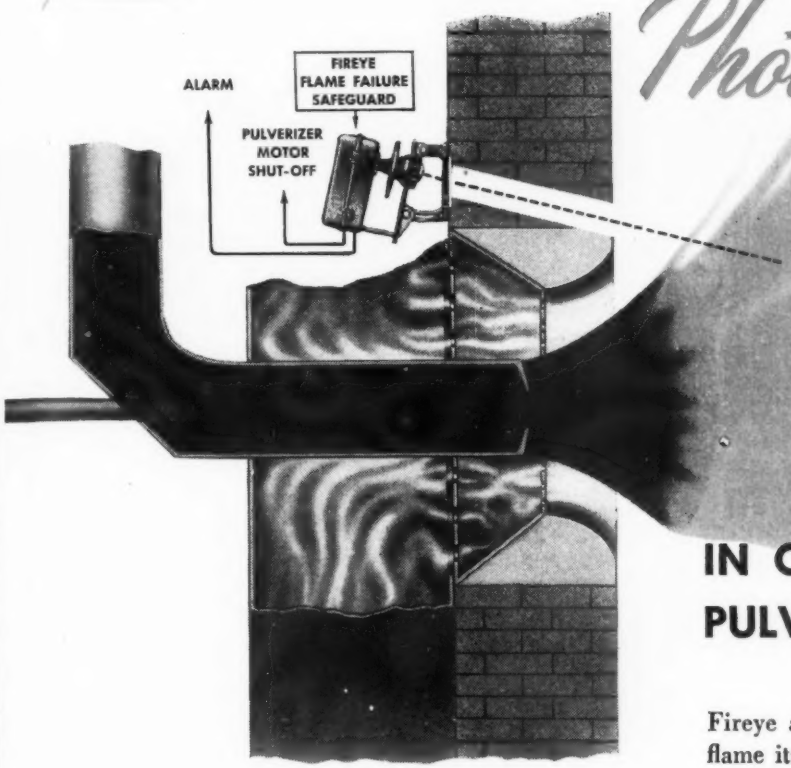


There are numerous variations of each unit —combinations are easily arranged to best serve you. Write for Bulletin No. 300.

A. W. CASH COMPANY
DECATUR, ILLINOIS

CASH STANDARD CONTROLS . . VALVES

fireye PREVENTS EXPLOSIONS *Photoelectrically*



IN OIL, GAS, OR PULVERIZED COAL BURNERS

Fireye acts with the speed of *light*—the light of the flame itself, watched at all times by the photoelectric eye. If the flame fails, Fireye prevents explosion by shutting off the fuel instantly, and sounding an alarm.

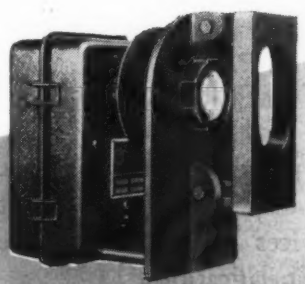
Explosions in pressure-fed heating equipment employing oil, gas or pulverized coal cause millions of dollars' damage annually. These explosions are the result of *delay*—a few vital seconds lost between flame failure and fuel shut-off, permitting the combustion chamber to fill with a highly explosive mixture.

Yet this dangerous interval is almost inevitable in any safety control system that depends in whole or in part upon temperature change, or flame characteristics *other than light itself*. Light is instantaneous. It acts upon the sensitive plate of the Fireye photocell, releasing a flow of electrons—a microcurrent that is amplified to operate a relay—control the fuel feed.

Only light controls Fireye. When the flame fails, Fireye shuts off the fuel *instantly*—prevents explosions. **For complete information, write for Catalog 50.**

★ ★ ★

FIREYE ELECTRONIC BOILER FEEDWATER CONTROLS are floatless, maintenance-free. They maintain desired water level automatically . . . provide low-level alarm and fuel cut-off. Write for Catalog 51.



FIREYE Controls Every Flame . . . monitors oil, gas, pulverized coal burners . . . observes pilot, main flame, or both . . .

FIREYE Provides Completely Automatic Control . . . is used alone for control of manually ignited burners, to turn off both main and pilot valves and sound an alarm . . . or, when burner is automatically fired, with programming relay to provide desired sequence of fuel pump and valve operation.

FIREYE Is Easily Installed . . . is mounted directly on the furnace . . . watches the flame through a small window in the wall of the fire chamber.

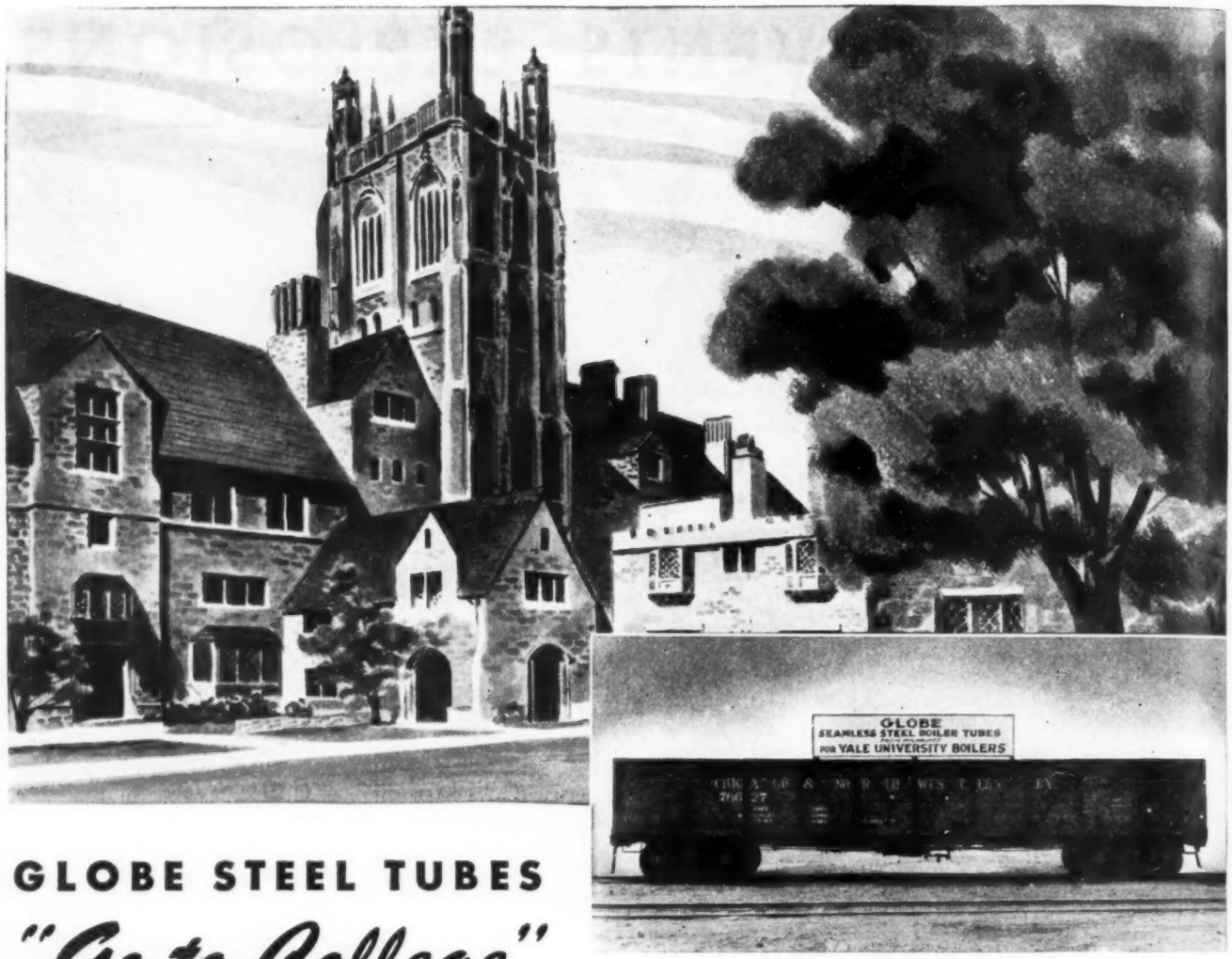
F-1

fireye

PHOTOELECTRIC FLAME SAFEGUARD

COMBUSTION CONTROL CORPORATION

Cambridge 42, Mass. • District Offices in all Principal Cities



GLOBE STEEL TUBES

"Go to College"

"The halls of learning" like Yale and Chicago Universities have at their command engineers and laboratories qualified to make all the critical tests on material bought for their own use. Globe Seamless Steel Tubes have gone into the boilers of their powerhouses to insure long and continuous operation at low maintenance costs.

Globe Seamless Steel Tubes of carbon, alloy, or stainless steel are made in a plant devoted for more than 30 years exclusively to the manufacture of steel tubing. Every order, large or small, is a special order and is checked at each stage of our exacting process of manufacture. The finished tubes are inspected with the most up-to-date testing devices to insure accurate filling of customer's specifications.

Globe Steel's customers have at their service our large technical staff and completely equipped laboratory. We will be glad to aid you in selecting steel tubing to meet your particular requirements.

★ STAINLESS TUBES
★ BOILER TUBES
★ GLOBEIRON TUBING
★ GLOWELD TUBES

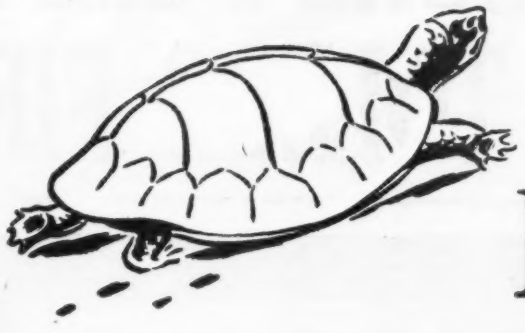
GLOBE TUBES

★ CONDENSER AND HEAT EXCHANGER TUBES
★ MECHANICAL TUBING

GLOBE STEEL

5010

GLOBE STEEL TUBES CO., *Milwaukee 4, Wis., U. S. A.*



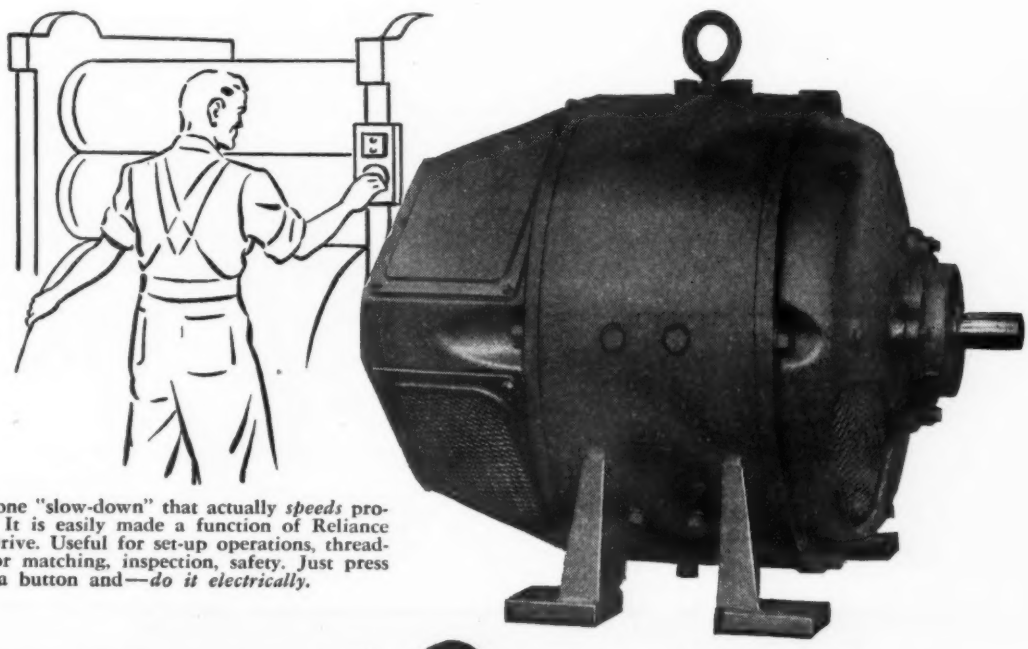
INCHING

Slow speed for inching, threading and close inspection of work in process is but one example of the versatility of Reliance motor-drive. Properly applied, motor-drive is more than power. In addition to controlled and variable speed, it can be the means of: smooth, controlled acceleration—automatic reversing, quick stopping—control of tension—tandem operation. With Reliance motor-drive these functions can be provided electrically, eliminating such mechanical devices as clutches and gears.

Reliance engineers have had wide experience in developing new uses for modern motor-drive and, in cooperation with plant engineers, adapting basic developments to specific industrial problems. Perhaps this experience can be usefully applied in *your* plant. It is available on request. Ask for Bulletin 311 showing application of an all electric adjustable speed drive for A. C. circuits.

RELIANCE ELECTRIC & ENGINEERING COMPANY
1088 Ivanhoe Road • Cleveland 10, Ohio

Birmingham • Boston • Buffalo • Chicago • Cincinnati • Detroit • Greenville (S.C.) • Houston • Los Angeles • Minneapolis • New York Philadelphia • Pittsburgh • Portland (Ore.) • St. Louis • Salt Lake City • San Francisco • Syracuse • Washington, D.C. • other principal cities



There's one "slow-down" that actually *speeds* production. It is easily made a function of Reliance Motor-Drive. Useful for set-up operations, threading, color matching, inspection, safety. Just press a button and—*do it electrically.*

RELIANCE A-C D-C MOTORS

A-C HIGH PRESSURE PUMPS SET RECORD IN TOLEDO FIRE

THIS PICTURE was taken 30 minutes after a 4-alarm fire broke loose in mid-town Toledo. *Greatest drain in history* of high pressure pumping station was reported when, during a 2-hour period, *all four* Allis-Chalmers fire pumps serving the station were in operation *at one time*. The pumps, installed in 1915, are 10″ by 10″, 5-stage units rated at 2000 gpm, 300 lbs. pressure each.

Photo Courtesy of Toledo Blade

TOLEDO, OHIO—2,400,000 gallons of water were pumped through local high pressure mains during a 6-hour period . . . shattering previous records. Pumpage was at a rate of 7,800 gpm, compared to previous high of 5,100 gpm. Four Allis-Chalmers High Pressure Fire Pumps set this new record after 29 years of service. That indicates dependability and durability — the kind of quality built into every A-C pump. ALLIS-CHALMERS, MILWAUKEE 1, WIS.

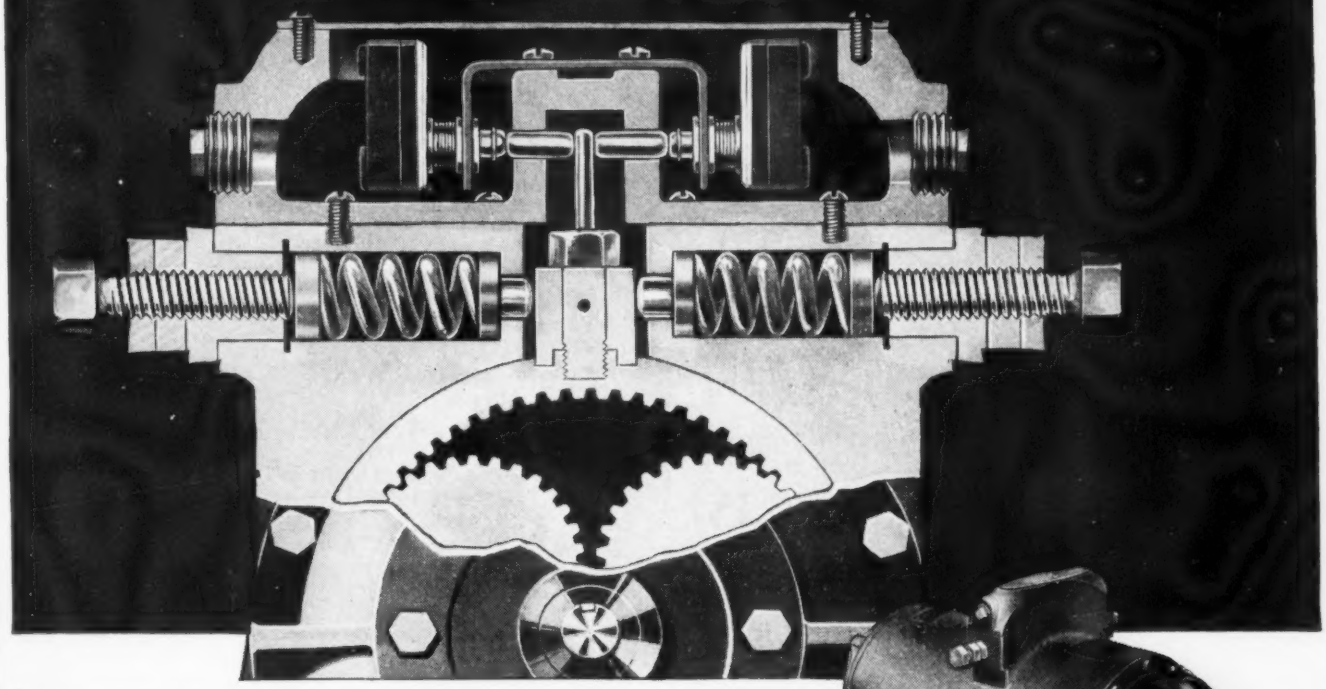
A 1737

ALLIS-CHALMERS CENTRIFUGAL PUMPS

Next time you need pumps — 10 to 150,000 gpm, heads to 2500 lbs. — call on Allis-Chalmers!

Instantaneous

OVERLOAD PROTECTION



Responds to overloads more quickly than electrical thermal relays

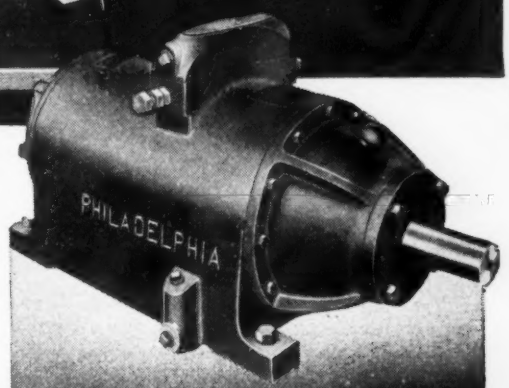
The PlaneTorque is a feature that can be incorporated into any MotoReduceR—*the built-in motor and speed reducer*—to protect both the driven machinery and the drive unit from overloads.

By direct mechanical action of the overload, motor current is automatically and instantly cut off when a pre-determined limit is reached. This action is quicker than electrical thermal relays provide. With fuse protection the fuses must be selected to carry the starting current of the motor. Therefore the protection during the running period is not adequate.

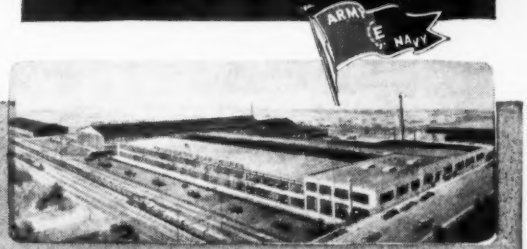
The PlaneTorque can be cut out during the starting period merely by holding down the starting button but will become operative during the running period when the button is released.

To restart the PlaneTorque-MotoReduceR after overload cut-off only removal of the excessive load is necessary . . . a big time saving feature.

For applications such as stoker drives, conveyor drives, mixers, roll drives, etc. . . . investigate the PlaneTorque MotoReduceR. Get our Catalog M. R. 40 for further details.



Philadelphia
PLANETORQUE
MOTOREDUCER



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GEAR WORKS INCORPORATED
ERIE AVE. AND G ST., PHILADELPHIA 34, PA. NEW YORK • PITTSBURGH • CHICAGO

Industrial Gears and Speed Reducers
LimiTorque Valve Controls

PLUG IN ANYWHERE ALONG THE LINE —WITH BULLDOG BUSTRIBUTION DUCT

This photo shows BullDog Bus Duct used on welder circuits. Note the short cable runs from overhead Plugs.

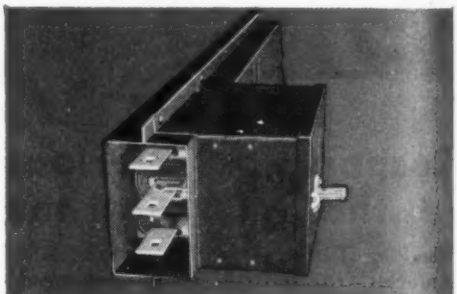
When you install Bus Duct, you wipe out a great many of your electrical power problems.

You can add new machines at will or move old ones to any location because ten plug-in openings are available in each standard 10-foot section of safely-enclosed duct casing.

This gives your workers a constant flexible source of power that is safe . . . convenient . . . clean . . . efficient.

Also, Bus Duct can be easily and quickly installed. Any plant electrician with a couple of helpers can put it up. And it is 100% salvable.

Those plants which have Bus Duct will be a long step ahead in reconverting to peace production. Our field engineers will be happy to help you with *your* power problems. Write today for complete descriptive Bulletin No. 427.



End view of Plug mounted on a duct section. Note how the copper "contact fingers" clamp over bus bars in duct.

Vacu-Break Switch plugs control and protect branch circuits. Special switch construction minimizes arcs.

Buy More War Bonds
Get In Your Scrap

BULLDOG
ELECTRIC PRODUCTS CO.

BOX 177, R. PK. ANNEX
DETROIT 32, MICHIGAN
BullDog Electric Products of
Canada, Ltd., Toronto, Ont.

Field Engineering Offices in All Principal Cities

ALSO MANUFACTURERS OF

VACU-BREAK SAFETY SWITCHES • SAFTOFUSE PANELBOARDS • SWITCHBOARDS • CIRCUIT MASTER BREAKERS • UNIVERSAL TROL-E-DUCT, *for flexible lighting* • INDUSTRIAL TROL-E-DUCT, *for movable "loads."*

SIVYER STEEL CASTINGS

you find it where you find this mark

The war production experience of many manufacturers has stimulated a new appreciation of the importance of dimensional accuracy in steel castings. Here at Sivyer we have always put special emphasis on it in molding and finishing operations. That's why Sivyer customers have always been accustomed to a high degree of dimensional accuracy. It's one of the many reasons why the Sivyer is worth looking for.

SIVYER STEEL CASTING COMPANY
MILWAUKEE CHICAGO

ARMY E NAVY

Even the best wire rope—alone—isn't enough. The buyer of rope for the vital war job of today and the cost-conscious job of tomorrow has a right to all that goes with good rope.

WHAT CAN YOU EXPECT from Roebling? Rope that has known capacity to deliver service. Engineering, in our plant and at your job, to put the rope to work right. Maintenance practices that protect its long life. » » Your postwar jobs and postwar profits will depend in part upon keeping rope-rigged equipment operating at lowest possible cost. You can leave that part to Roebling.

JOHN A. ROEBLING'S SONS COMPANY
TRENTON 2, NEW JERSEY • Branches and Warehouses in Principal Cities

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Wire Rope and Strand • Fittings • Cold Rolled Strip • Aircord, Swaged Terminals and Assemblies • Round and Shaped Wire Wire Cloth and Netting • High and Low Carbon Acid and Basic Open Hearth Steels Suspension Bridges and Cables • Electrical Wires and Cables • Aerial Wire Rope Systems

TYPICAL DIESEL LUBRICATION PROBLEMS:

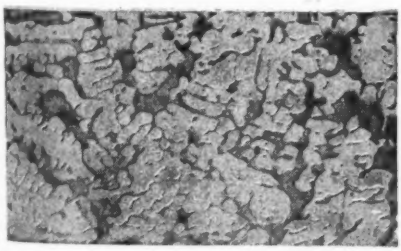
2. Bearing Corrosion

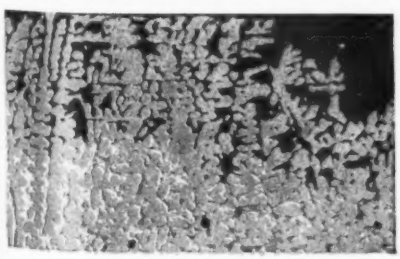
The high speeds of automotive Diesel engines have increased the loads on bearings to such an extent that copper-lead and other alloy bearings are widely used. These bearings, although able to withstand far greater pressures and higher temperatures than the conventional babbitt type, are subject to corrosion.

These same conditions of pressure and temperature promote a reaction between the lubricating oil and the air in the crankcase. When a hydrocarbon lubricating oil is exposed to oxygen at elevated temperatures, the oxygen atoms combine with the oil molecules. With some lubricating oils, this reaction causes them to become corrosive.

The products formed in this reaction tend to dissolve the lead in the copper-lead structure of the bearing, leaving a porous copper shell which breaks down under pressure.

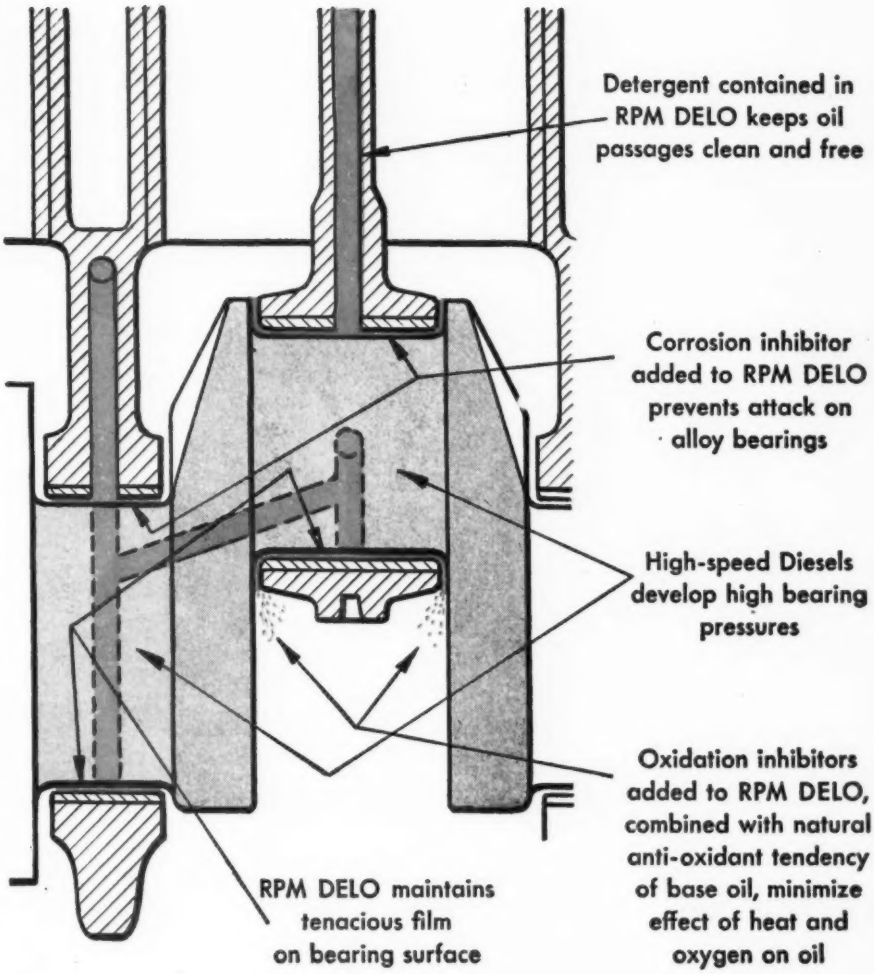
This tendency, which presents a serious problem to operators of high-speed Diesels, can be entirely overcome through use of RPM DELO in accordance with the recommended procedure.





Top Photo: A photomicrographic cross-section shows the lead component of a new copper-lead bearing in light grey. The copper is shown as red. Note the even distribution throughout.

Bottom Photo: A similar cross-section corroded by use of straight, uncompounded mineral oil. Note how lead has been eaten from surface, leaving copper honeycomb.


Detergent contained in RPM DELO keeps oil passages clean and free
Corrosion inhibitor added to RPM DELO prevents attack on alloy bearings
High-speed Diesels develop high bearing pressures
Oxidation inhibitors added to RPM DELO, combined with natural anti-oxidant tendency of base oil, minimize effect of heat and oxygen on oil
RPM DELO maintains tenacious film on bearing surface

Diagrammatic sketch of connecting rod and crankshaft bearing assembly illustrates one section of engine where RPM DELO reduces overhaul and repair expense.

RPM DELO, in addition to its other properties, prevents bearing corrosion in three separate ways:

1. The base stock of RPM DELO contains natural inhibitors which are highly resistant to oxygen, and minimize the original tendency of all mineral oils to oxidize under heavy-duty conditions.

2. A powerful oxidation inhibitor is added to RPM DELO, which further reduces the rate at which the oil absorbes oxygen.

3. Direct protection is given to the bearing by the corrosion inhibitor added to RPM DELO.

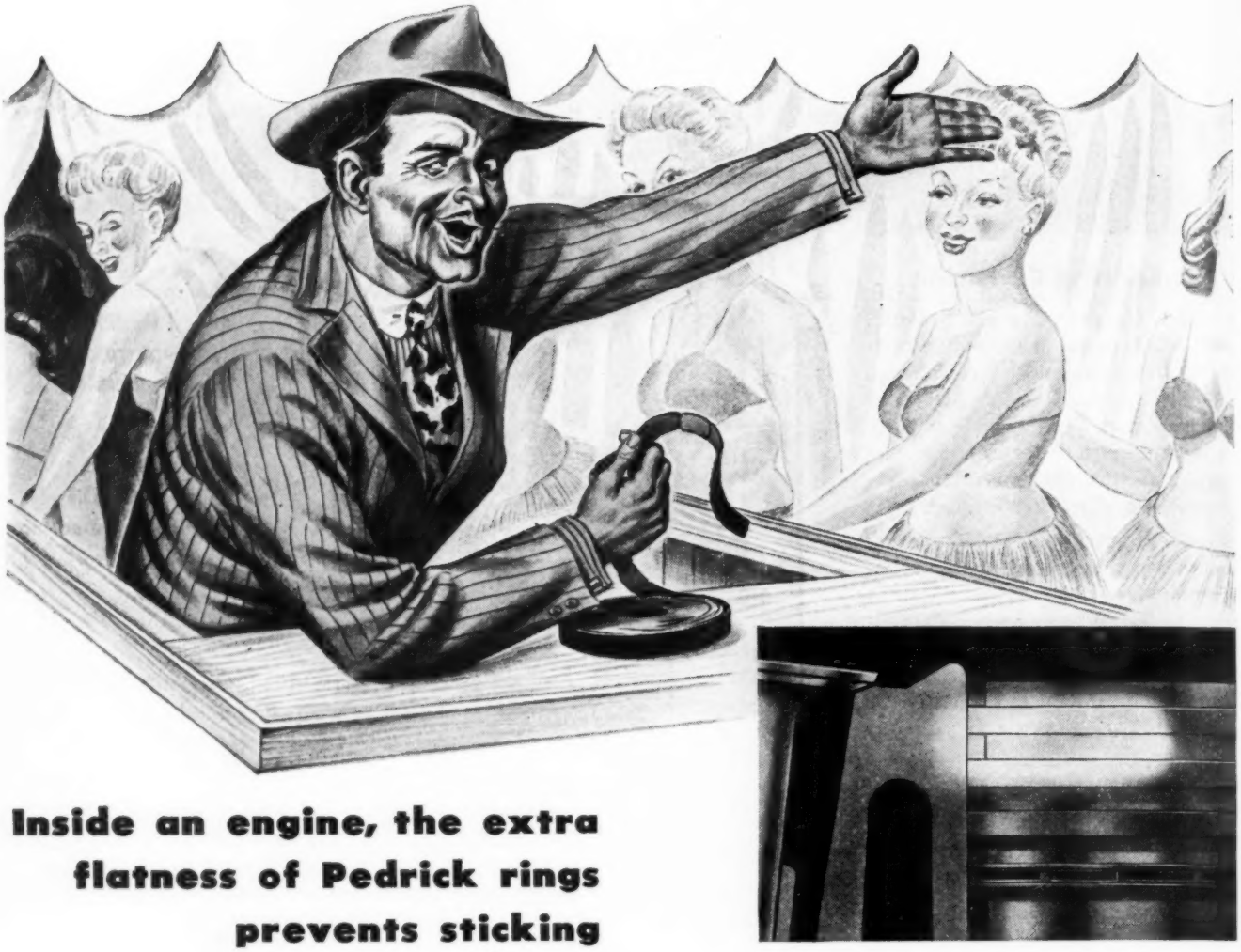
Even more important than its non-corrosive property, is the ability of RPM DELO to eliminate ring-sticking, prevent excessive deposits on rings and ports, and minimize ring and cylinder wear.

RPM DELO has world-wide distribution and is marketed under the following names: RPM DELO, Caltex RPM DELO, Kyso RPM DELO, Signal RPM DELO, Sohio RPM DELO, and Imperial RPM DELO (concentrate). Ask your Diesel engine manufacturer or distributor for the RPM DELO supplier in your vicinity.

RPM DELO

STANDARD OF CALIFORNIA

It's what goes on INSIDE *that counts*



Inside an engine, the extra flatness of Pedrick rings prevents sticking

INCREASED gas and oil consumption . . . less power . . . greater wear . . . shorter time between overhauls—these are troubles caused by rings that haven't a sufficient degree of flatness. They stick in the piston grooves and are no longer able to give proper seal.

Pedrick's double-disk, lap-grinding process makes rings so flat that those as small as 2 inches in diameter can be stacked 6 feet high without tottering! And they *stay* flat, too, because the exclusive Pedrick method of Heat-Shaping relieves the stresses set up in the metal from machining operations. Each grain in the metal is set for life, preventing warping at high speeds.

The wide acceptance of Pedrick rings by industry, for both original equipment and replacements in all kinds of engines, compressors, pumps, and hydraulic equipment, is the direct result of high performance and long life under actual service conditions. Pedrick *precisioneered* rings are made in all types and sizes up to 36″ in diameter. Write today for the complete story on Pedrick *precisioneering*. WILKENING MANUFACTURING Co., Philadelphia 42, Pa. *In Canada:* Wilkening Manufacturing Co. (Canada) Ltd., Toronto.

BOND DAY IS EVERY DAY . . .
KEEP BUYING

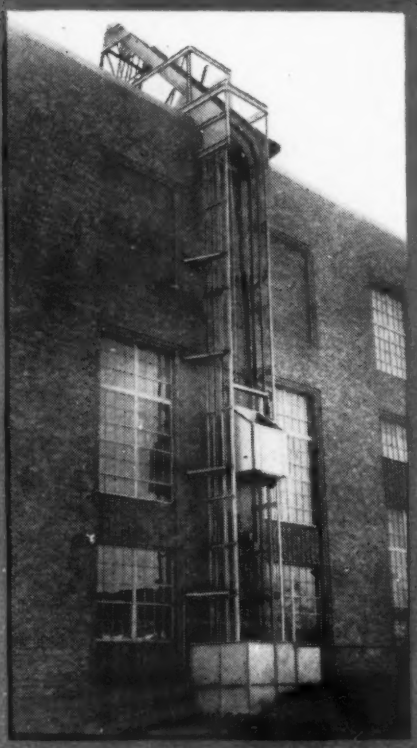
Pedrick

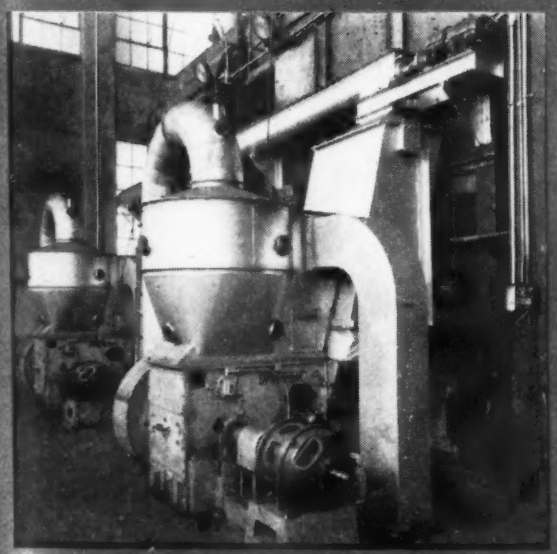
precisioneered **PISTON RINGS**

Only One Responsibility with

FAIRFIELD

Coal & Ash Handling Equipment





● Fairfield not only engineers the complete coal and ash handling equipment to meet your specific condition but builds and installs it—and makes it work to your satisfaction. You have only one responsibility with Fairfield Coal and Ash handling equipment.

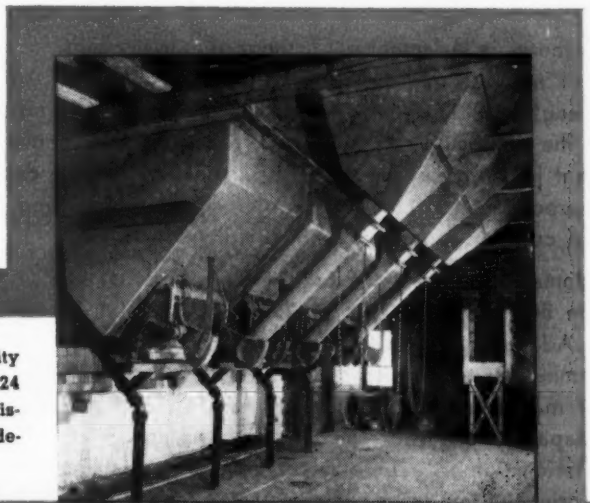
Illustrated—top left—the Fairfield Skip Hoist handling coal from pit to coal bunker inside boiler house. This is a ruggedly built unit—automatic in its operation — spill proof — and economical as to maintenance. Fairfield Skip Hoists have a record of many years of successful, trouble free operation.

Bottom left—shows a Fairfield Screw Conveyor feeding unit pulverizers. Coal is being delivered from storage to pulverizers at a constant rate depending upon boiler demand.

Directly below are shown ash hoppers and gates located below boiler room floor for disposal of ashes.

If you are thinking about converting to coal or erecting a plant requiring the handling of coal and ashes you will find the Fairfield System both efficient and complete. Consult a nearby Fairfield representative or

WRITE for full descriptive catalog.



Ash hopper for each 155,000 lb. boiler has a capacity of 435 cu. ft.—is 20 feet long—provided with four 24 inch x 36 inch balanced ash grates. Soot is discharged directly into ash hopper and siftings delivered to ash cars.

THE FAIRFIELD ENGINEERING CO.- MARION, OHIO

BUILDERS OF COAL AND ASH HANDLING EQUIPMENT

ADAMANT
FIRE BRICK CEMENT

It's SMOOTHER because it's "AIR FLOATED"

The exceptional smoothness of Adamant Fire Brick Cement is attained by a process in its manufacture known as *"Air-Floating"* which eliminates the larger, coarser particles and leaves only the basis for a finer, smoother cement. The resulting exceptional, uniform smoothness of Adamant permits making the highly desirable thin joints which literally weld the brick together.

Furthermore Adamant is a cement of unusally high bonding strength. Laboratory tests made by a leading technical institute show that it possesses a bonding strength of 800 pounds per square inch at room temperature and 1270 pounds to the square inch at 2600°F. It has a P. C. E. of over 3000°F. The thin Adamant joints, highly resistant to flame, heat and the destructive action of gases, appreciably lengthen the life of the furnace wall and thereby reduce the time and cost for repairs or re-building.

Adamant, the *original* high temperature Fire Brick Cement and the complete line of Adaproducts, including Adahearth, for forming monolithic hearths . . . Adacast, for making special fire clay shapes . . .. Adapatch, for patching walls, checking deterioration . . . are carried in stock by distributors in principal industrial centers. Write for the name of the Adaproduct distributor nearest you.

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784 SOUTH SWANSON ST., PHILA. 47, PENNA.

In Canada: Canadian Botfield Refractories Co. Ltd., 171 Eastern Avenue, Toronto

POWERED WITH THREE STERLING ADMIRAL ENGINES

A LIGHTNING blur as the slim, grey hull streaks in—a white trail of foam on an azure sea—a blinding flash —a thunderous roar—and it's "bottoms up" to another enemy ship.

Swift, powerful, deadly, despite their midget size, the mosquito fleet has struck terror to enemy shipping in every theatre of operation.

And the success of these small craft is due largely to the Sterling engines in their holds—engines so powerful that they have aptly been called "masterpieces of precision design."

Compactness and precision are characteristic, too, of the Foote Bros. gears that aid these engines in delivering their power. For today, these high precision gears are being turned out on a production basis made possible by new manufacturing techniques—new production know hows.

When the war is won, such high precision Foote Bros. gears will offer American manufacturers new efficiencies in power transmission for machines of peace.

FOOTE BROS. GEAR AND MACHINE CORPORATION
5225 South Western Boulevard, Chicago 9, Ill.

FOOTE BROS.

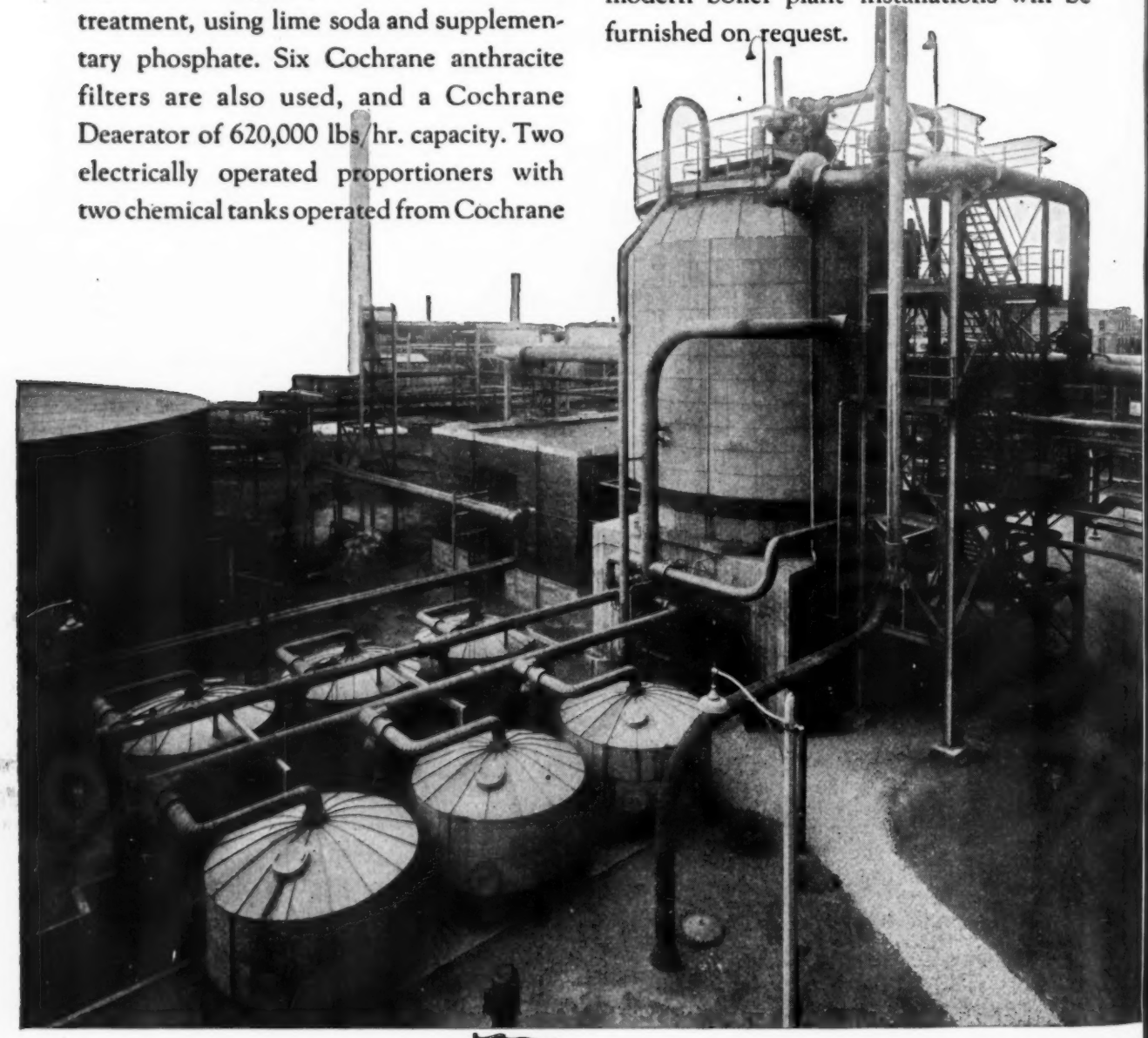
Better Power Transmission Through Better Gears

ULTRA-MODERN WATER CONDITIONING

Using Latest Design Cochrane Equipment—

In this, one of the most carefully designed boiler plants constructed in recent years, a Cochrane Hot-Process Water Softener of 80,000 GPH capacity is used for the water treatment, using lime soda and supplementary phosphate. Six Cochrane anthracite filters are also used, and a Cochrane Deaerator of 620,000 lbs/hr. capacity. Two electrically operated proportioners with two chemical tanks operated from Cochrane controls on panel board are also part of this installation.

Complete details of this and many other modern boiler plant installations will be furnished on request.



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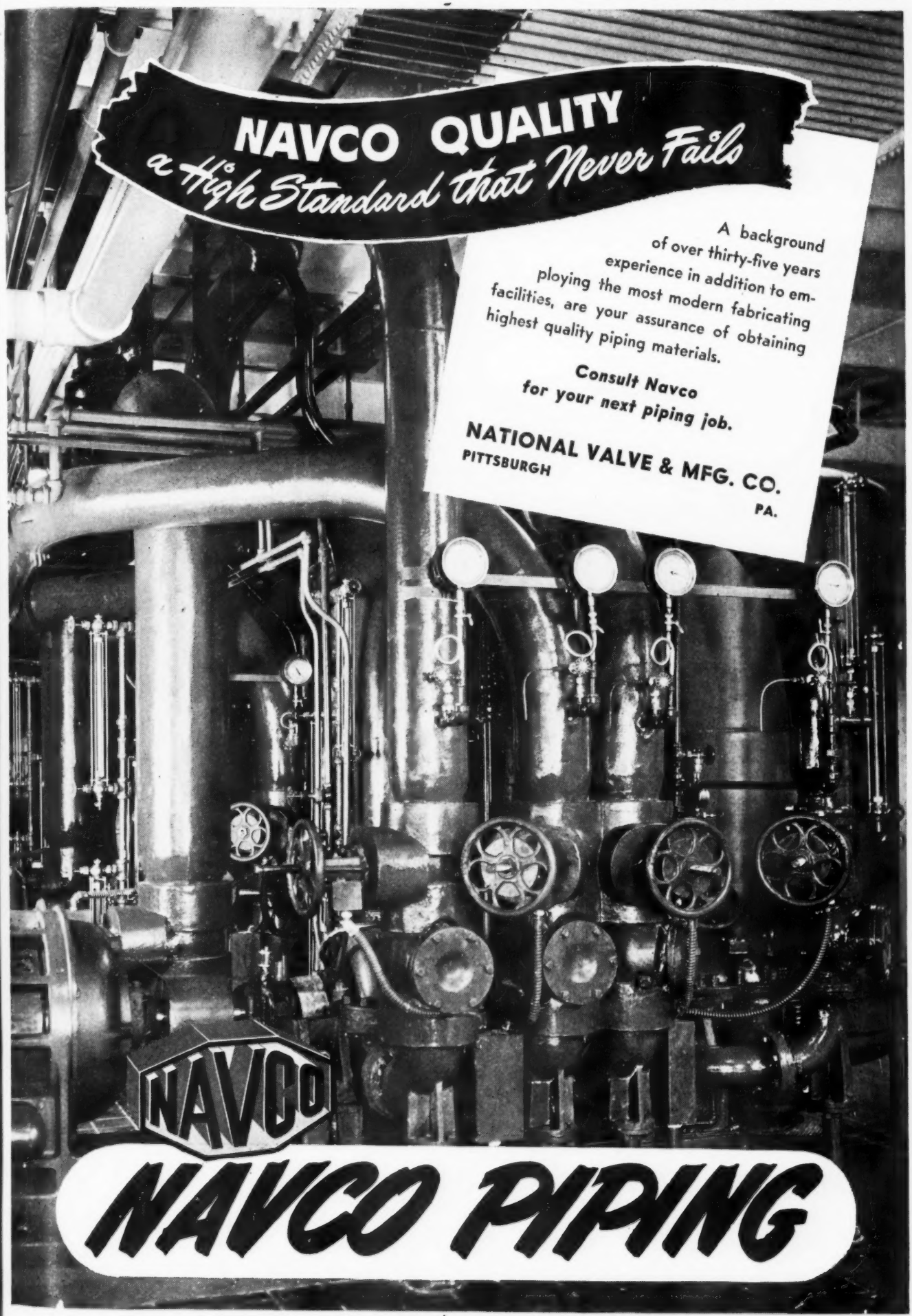
SOFTENERS • DEAERATING SOFTENERS • DEAERATORS • METERS • STEAM SPECIALTIES


NAVCO QUALITY
a High Standard that Never Fails
A background of over thirty-five years experience in addition to employing the most modern fabricating facilities, are your assurance of obtaining highest quality piping materials.
Consult Navco for your next piping job.
NATIONAL VALVE & MFG. CO.
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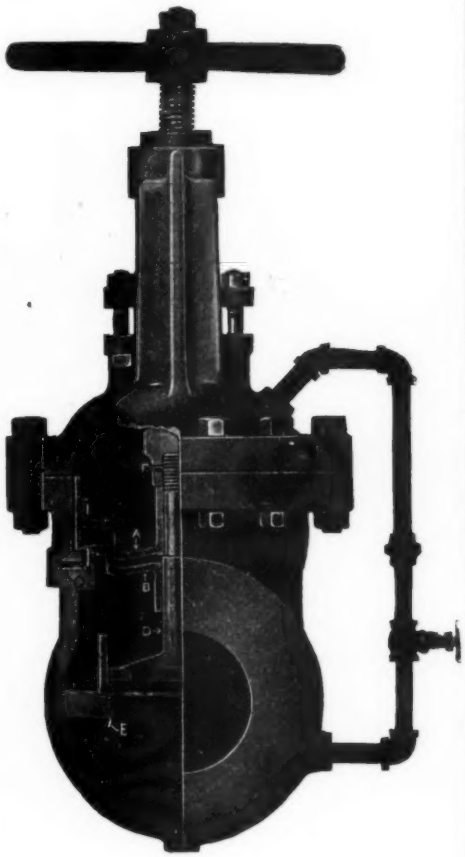
NAVCO
NAVCO PIPING

GOLDEN-ANDERSON

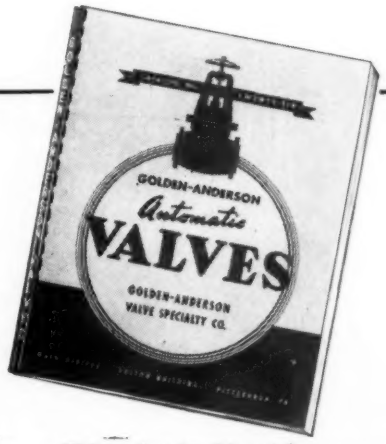
Throttle and Emergency Stop Valve



• • • instantaneous automatic protection against runaway engines and turbines

● No unit can exceed safe operating speed when equipped with the G-A Throttle and Emergency Stop Valve. It works instantly . . . can be furnished to operate mechanically, electrically, by hand or remote control. This valve offers positive life and property protection against the dangers of overspeeding turbines and engines and permits the location of trouble before damage occurs.

This unit is supplied in angle and globe patterns in sizes from 2½" to 16". Valve trim may be bronze, monel, stainless steel or Gallavoy, according to pressure and temperature conditions. Seat rings and disc may be stellited.

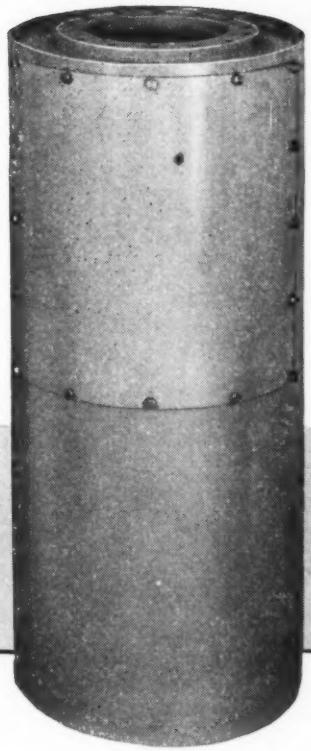


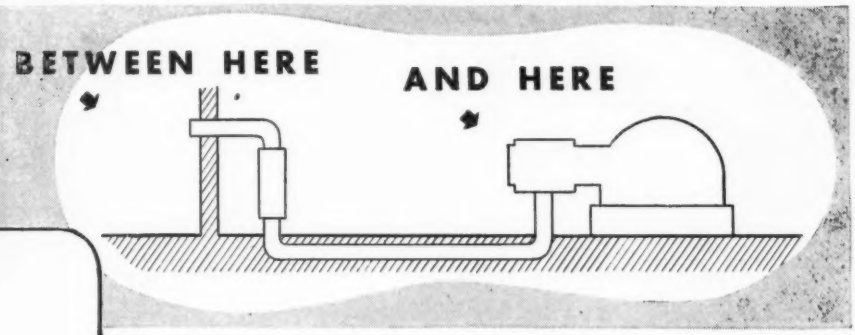
Write today for this catalog . . . describes the complete line of G-A Specialty Valves.

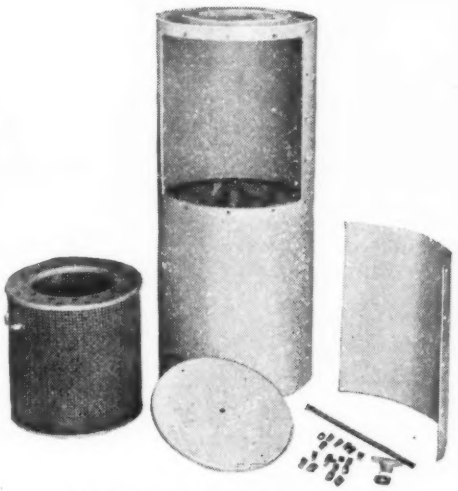
GOLDEN-ANDERSON VALVE SPECIALTY CO.

FULTON BLDG. PITTSBURGH, PA.

NEW *in-Line* FILTER-SILENCER FITS ANYPLACE







Multimaze (viscous impingement) type in-line filter. Disassembled, showing ease of inspection and servicing.

Air-Maze filters fit the job. The Air-Maze line includes more than 3,000 types of filters. Send for catalog AGC-144 showing typical filters and installations.

Don't compromise on these two vital locations!

★ The coolest, cleanest air for your engine and compressor and the handiest location for intake filters often are far apart.

Cool air increases the volumetric efficiency of your equipment. High inlets often reduce dust concentration of intake air. Convenient location speeds and simplifies filter inspection and servicing.

The new Air-Maze *in-line* (closed circuit) filter-silencer—available in both oil-wetted and oil-bath types—ends the need for compromise on these important considerations. Designed on the proved Air-Maze principle, this new unit offers efficient, dependable protection, effective silencing and complete flexibility of induction system design.

We shall be glad to make recommendations for your particular installation.

AIR-MAZE CORPORATION • ***Engineers and Manufacturers*** • **CLEVELAND 5, OHIO**

Representatives in Principal Cities • ***In Canada:*** **Williams & Wilson, Ltd., Montreal, Quebec, Toronto, Windsor; Fleck Bros. Ltd., Vancouver, B. C.**

ARMY E NAVY

AIR-MAZE

SPECIALISTS IN AIR FILTRATION

Irrigation transforms the dusty desert into orchards or gardens. But irrigation means far more than simply pouring water into the wilderness. The scientific study of soil conditions, climate, chemicals and other related factors makes all the difference between failure or fruitfulness.

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IS PREPARED TO RENDER

COMPLETE MODERN and SCIENTIFIC

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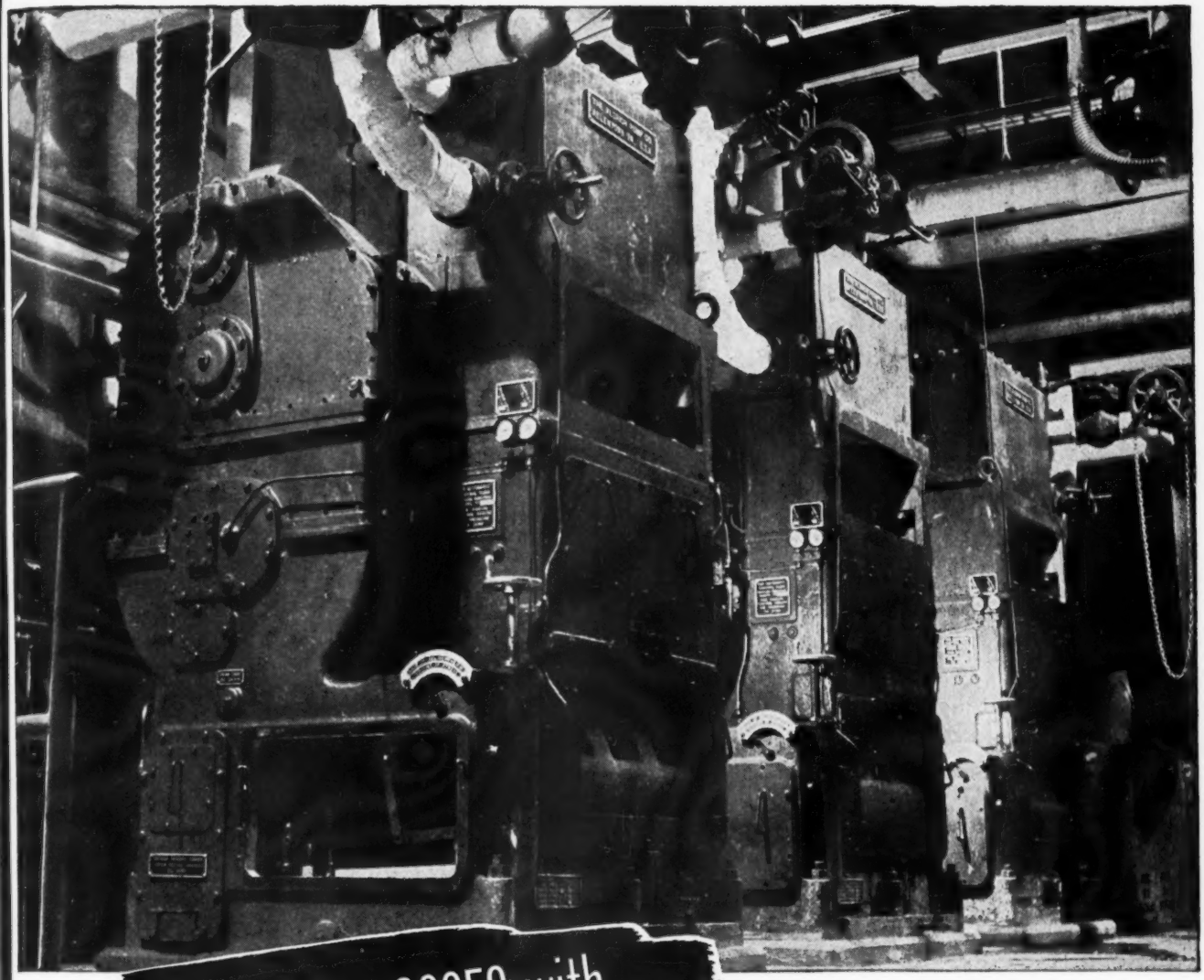


CUT POWER LOSSES with . . .

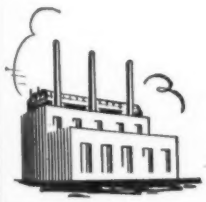
. . . ALDRICH-GROFF CONTROLLABLE CAPACITY "POWR-SAVR" PUMPS

Aldrich-Groff pumps on unit feed systems eliminate pressure and power losses common to throttling-type feed regulating valves and offer advantages of feed system simplicity, efficiency and mechanical reliability for small and medium installations at medium and high steam pressures.

Equally important overall power savings are effected by Aldrich-Groff pumps on de-superheater feed service in connection with high pressure topping units for power stations of any size.

The three Aldrich-Groff 3¼" x 0 to 6" variable stroke vertical triplex pumps shown above are in service in a mid-western central station employing the unit system for main boiler feed. Two are driven by constant speed motors and the third by a constant speed steam turbine. Power consumption is almost directly proportional to pump delivery.

The 6" stroke — 3¼" plunger pump is a 100 HP unit and when operating at maximum speed can deliver 70,000 pounds of feed water per hour against 1025 pounds boiler pressure.



WRITE TODAY . . .

for bulletins and material giving full details, sizes and ratings of Aldrich-Groff Pumps.

THE ALDRICH PUMP CO. ALLENTOWN • PENNA.

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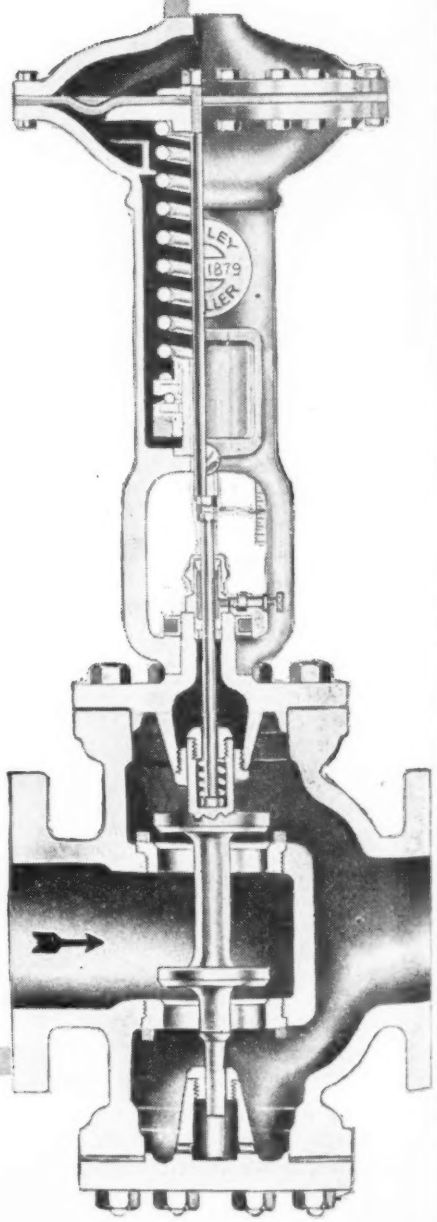
Sensitive

AS A CAT'S WHISKER!

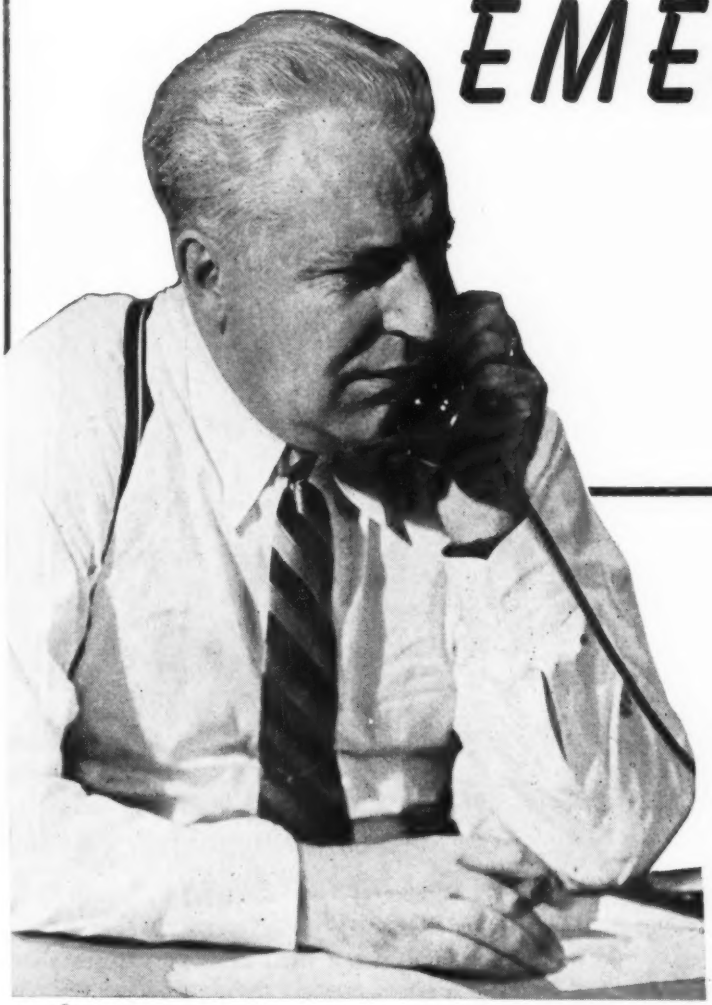
Where extremely accurate pressure regulation of steam, oils, liquids, gas or air is of prime importance, the K & M Diaphragm Motor Valve is the prime choice. Designed especially for use with air-operated instruments or auxiliary pilot units, this precision valve can be furnished with various types of inner valves—to meet exactly your different conditions of flow and pressure. Its patented special features assure minimum friction-lag and maximum efficiency. Furnished in sizes ½" to 12", pressure to open or close, or single-seated for positive shut-off. It also is available with finned bonnet for very high or very low temperatures. Submit your problems to our Engineering Department for specific recommendation.

Write for General Catalog 66

KIELEY & MUELLER, INC.
MANUFACTURERS OF PRESSURE AND LEVEL CONTROLS
NORTH BERGEN, NEW JERSEY



EMERGENCY Is Our NORM



It is better, of course, to avoid breakdowns by having condensers inspected when your boilers are shut-down in regular course.

Condenser tube failure can be forestalled by hydrodynamic testing of tubes and replacing those that blow under test.

Hurry calls are often our summons. At all hours of day and night, phone calls and telegrams come in requesting emergency service on all types and makes of condensers.

You can depend on us in emergencies. Our crews are ready for breakdown correction, and arrive equipped to do the job. No surveying the situation, sending back for tools or equipment, or other useless maneuvers. Instead, our crews know their business, have what it takes, and proceed directly to remedy the trouble and get your units back in service.

These are emergency times—so, when you have condenser emergencies, call Conseco.

Condenser Service AND ENGINEERING CO., INC.

81 RIVER STREET, HOBOKEN, NEW JERSEY

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NEW JERSEY TELEPHONE—HOBOKEN 3-4425

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AFTER 6 P. M. AND SUNDAYS—HOBOKEN 3-4428

5-CS 4

"If you want insulation that is rust-inhibitive, you want ME!"

In addition to doing a tremendously efficient job of insulating, Eagle Super "66" actually inhibits rust! Now, more than ever before, engineers appreciate this feature because they realize the need for protection of heated equipment.

"Springy Ball" structure

The high insulating efficiency of Eagle Super "66" is due primarily to the springy pellets of Eagle Mineral Wool that are its principal ingredient. Each pellet, or "springy ball," contains thousands of tiny "dead" air cells which give extremely low thermal conductivity. Pellets retain their cellular structure after application—provide permanent, heat-saving protection.

Eagle Super "66" is all-purpose—reclaimable

This unique plastic insulation can be applied easily, quickly, and with equal effectiveness to almost any shape or size surface. It withstands a full range of temperatures up to 1800° F., and, if not used at temperatures above 1200° F., *can be removed, remixed and reused!* The exceptionally high dry coverage of Super "66" gives lower cost per square foot than most insulating cements and blocks.

Any insulation worth installing is worth protecting. With Super "66" we recommend Eagle *INSULSEAL,* a tough, weatherproof coating that guards insulation from damage.

FREE Manual! Shows how insulation on a single Boiler Shell can save up to $1,500 a year in fuel costs. Gives other examples. Includes Heat Loss Estimate Sheet for your plant.

Find out how *you* can save industrial heat and power with mineral wool insulation. Write for *your* FREE copy today! Address Insulation Division, Eagle-Picher Lead Company, Cincinnati (1), Ohio.

★ *Speed the Victory with MORE War Bonds!* ★

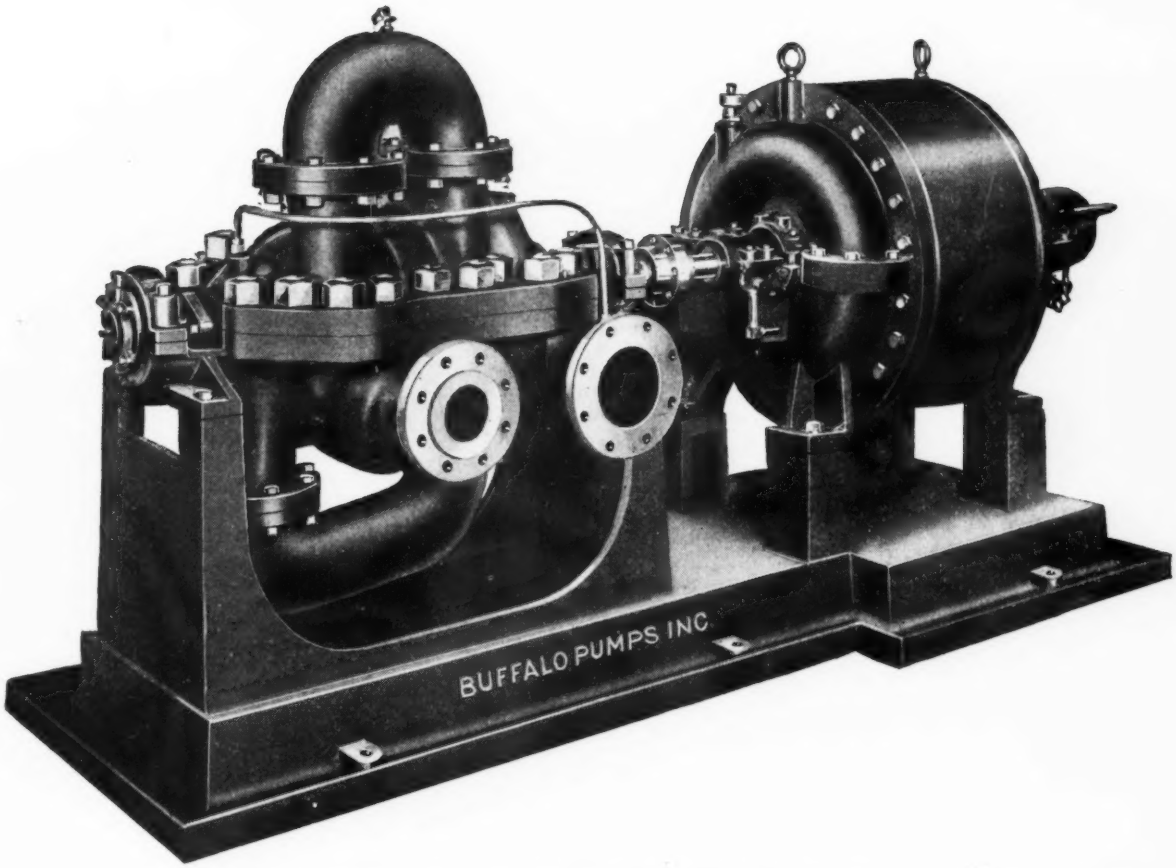
EAGLE-PICHER HIGH TEMPERATURE INSULATIONS

Eagle Super "66" Plastic Insulation
Eagle Supertemp Block
Eagle L-T and M-2 Felt
Eagle Blankets

EAGLE EP PICHER

Eagle Finishing Cements
Eagle Loose Wool
Eagle Insulseal
Eagle Insul-stic

THE EAGLE-PICHER LEAD COMPANY, Cincinnati (1), Ohio



Now, it CANNOT be told!

We can't say what we'd like to in this advertisement. We can't tell you where our pumps are going—or what they're doing. We can't even quote the service reports which praise their performance.

We can only say that we are still building pumps that really PERFORM on tough jobs—that we're building more in a month than we formerly built in a year—and that we will be better able to serve you than ever in the past.

Buffalo Pumps are not low-priced but they are worth the extra that fine quality always costs.

BUFFALO PUMPS, INC.

488 BROADWAY **BUFFALO, N. Y.**

Canada Pumps, Ltd., Kitchener, Ont.

"Buffalo"

Centrifugal PUMPS

A life-giving drink of fresh sea water

PERMUTIT DESALTING BAG
INSTRUCTIONS
1-FILL BAG TO LINE WITH SEA WATER
2-ADD BRIQUET OF CHEMICAL. ROLL TOP OF BAG DOWN AND STRAP SECURELY.
3-ALLOW BRIQUET TO STAND FOR A FEW MINUTES. THEN KNEAD BAG WITH HAND FOR 10 MINUTES UNTIL BRIQUET IS BROKEN INTO A FINE POWDER.
4-SHAKE BAG OCCASIONALLY FOR 20 MINUTES SO DESALTING MATERIAL IS KEPT IN CONTACT WITH WATER.
5-NOW SUCK CLEAR FILTERED DRINKING WATER THROUGH OUTLET TUBE.
THE PERMUTIT COMPANY
WORLD'S LEADING WATER CONDITIONING SPECIALISTS FOR MORE THAN 30 YEARS
PATENT PENDING

THIS flyer, down at sea, may suffer many hardships. But he'll be spared the most dreaded of all—thirst. He'll drink sea water—and live!

Stowed in his rubber raft, he'll find a Permutit Sea-water Desalting Kit. It consists of a plastic bag and a supply of salt-removing briquets. That's all he'll need to change salt sea water into fresh, clear drinking water in a few minutes. The kit occupies only one-tenth the space of the drinking water it produces.

The Desalting Kit was developed by chemists and engineers at Permutit, and accepted by the U. S. Navy, Army and Air Transport Command.

Permutit is helping thousands of war plants and Army and Navy establishments to do a better war job. We are proud indeed that our skill enables us also to make the tough job of our front-line fighting men a little easier, a little safer.

The Permutit Co., Dept. A, 330 West 42nd St., New York 18, N. Y. Permutit Co. of Canada, Ltd., Montreal.

*Trademark Reg. U. S. Pat. Off.

PERMUTIT

Serving industry and the armed forces...with GOOD WATER

JUST SUPPOSE!

by Barbara Brown

Olney High School, Philadelphia, Pa.

Note: Several weeks ago, the United States Treasury Department and the Columbia Scholastic Press Association sponsored an editorial contest for the nation's high school students. Subject: War Bonds. Winner: 15-year-old Barbara Brown, a Philadelphia high school junior. In the interests of helping the Fifth War Loan Drive, now in progress, we are proud to print here the stirring message written by Miss Brown.

SUPPOSE *there were no tomorrows?* . . . Think about it for just a minute . . . No tomorrow for you, or your kid sister at home—or the brother who left for the Army yesterday. Did you ever think that we, who have had so few yesterdays, may have no tomorrows?

It *has* happened, you know. To Jack Feldman, and to Bob Ernest—and to fifteen other boys who sat in our classes just last year . . .

They will have no tomorrows. They died before they ever had a try at living . . . so that we here at home might have our chance.

There are millions who were asked to give up more than a double feature at the Earle . . . or a spiffy new pair of pumps for next week's formal. A soda is a pretty insignificant sacrifice, when you think of things like—

The kids in Russia, who live on a few ounces of cereal a day. *They've never seen an ice-cream soda.*

The Polish boys and girls, who would be in school right now, just as we are . . . *if there were any schools left.*

The French youths who've never had a hamburger when they were out on a date—or any other time, for that matter. They are old, very old . . . *older than you and I will ever be. . .*

There are millions of them . . . in Norway . . . Holland . . . Denmark . . . Belgium . . . They would stare in amazement if they could be here to see—

A jalopy painted bright yellow. "The Tin You Love To Touch" printed in big, green letters on the back.

A high school senior, uncomfortable in his first tuxedo . . . calling for his date, looking nervous.

Millions of things that we take for granted . . .

There is such a feeling of permanency in our tight little world. We'll go to school with the gang, today . . . and tomorrow . . .

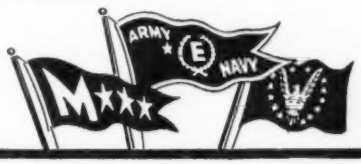
BUT, WHAT IF THERE WERE NO TOMORROWS? There's only one way to be sure, you know—

Buy War Bonds . . . That's a simple little phrase. It's the American way of saying what we mean in a few direct words. *Buy War Bonds.*

Yes—you and everybody must buy War Bonds. We've *got to* buy more and more and more of 'em. Just get the idea into your head that your $18.75 might—just *might* end the war one-fifth of a second sooner. That maybe, in that one-fifth of a second, the boy next door could be on the receiving end of a bullet . . . Then you'll know that it's worth any small sacrifice you have to make!

We've got to keep on plugging, saving, convincing. Giving our pin money . . .

Tell everybody—sell everybody! We can't take no for an answer . . . Because we are buying *tomorrow—and tomorrow—and tomorrow.*



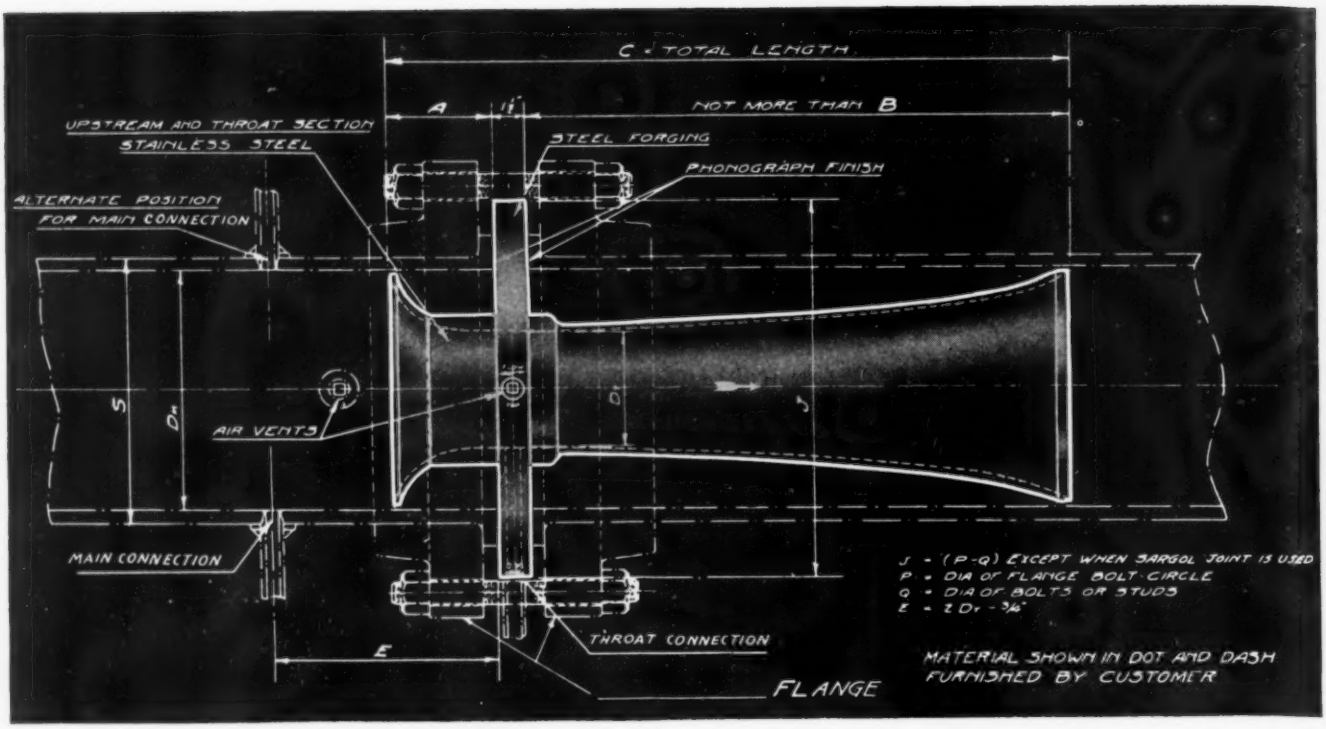
SUPERIOR ENGINES

Division of The National Supply Co.

Executive Offices: Pittsburgh, Pa.

Sales Offices: Springfield, O.; Boston; New York; Philadelphia; Washington, D. C.; Jacksonville; Houston; Ft. Worth; Tulsa; Los Angeles; Chicago. Factory: Springfield, Ohio.

★ KEEP BUYING WAR BONDS ★


C = TOTAL LENGTH
A
NOT MORE THAN B
UPSTREAM AND THROAT SECTION STAINLESS STEEL
STEEL FORGING
PHONOGRAPH FINISH
ALTERNATE POSITION FOR MAIN CONNECTION
AIR VENTS
MAIN CONNECTION
THROAT CONNECTION
FLANGE
J = (P-Q) EXCEPT WHEN SARGOL JOINT IS USED
P = DIA OF FLANGE BOLT CIRCLE
Q = DIA OF BOLTS OR STUDS
E = 2 Dr - 3/16"
MATERIAL SHOWN IN DOT AND DASH FURNISHED BY CUSTOMER

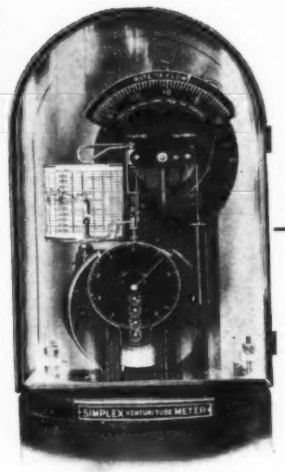
SIMPLEX INSERT VENTURI TUBE (TYPE "TG")

with MO Flow Rate Meter

INSTALLED IN EXISTING LINES... PROVIDES STANDARD VENTURI HEAD QUANTITY

Simplex "TG" Tubes are easily inserted in pipe lines of 3" diameter and up, and provide a convenient, accurate means of establishing differential head characteristics which are as dependable as those obtained from standard Venturi Tubes, with a loss of head considerably lower than in orifice plates.

For high or low pressure lines any required material may be used such as steel, bronze, stainless steel, cast iron, etc. The flange can be furnished to fit any type of pipe joint or welding ring. The cost of a "TG" Tube is relatively low.

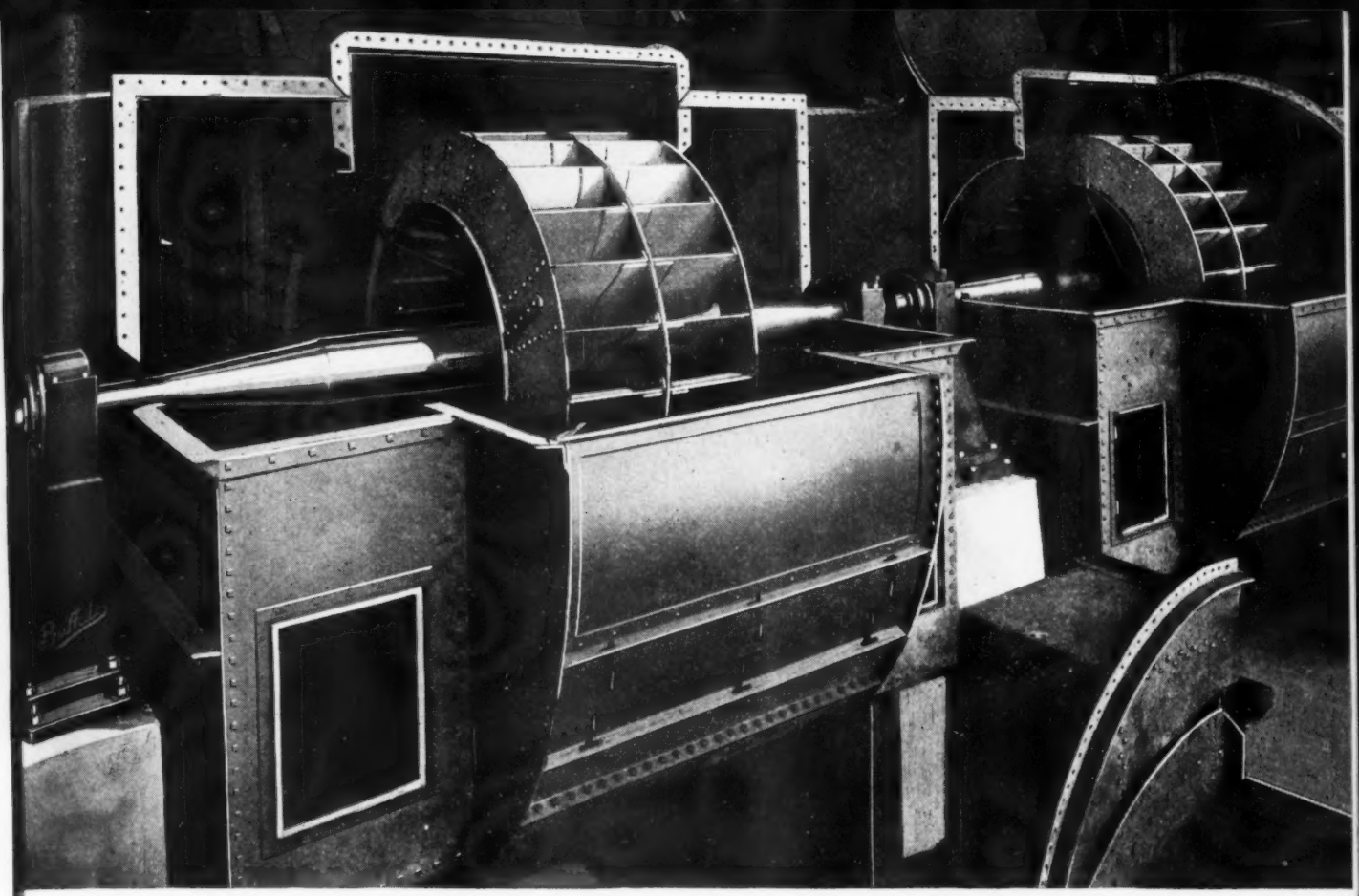


THE SIMPLEX MO METER

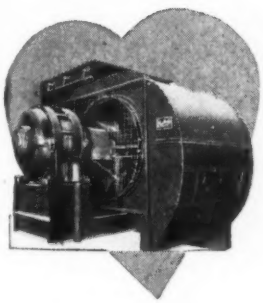
Simplex "TG" tubes in combination with MO Meters (indicating, recording, totalizing) are widely used for the accurate flow rate measurement of water, oil, gases, air, and industrial liquids. Many power and industrial plants measure fluids of all types with this simple, efficient, primary device and meter, which converts differential pressure heads into rates of flow.

Write today for further information and details of installation of Simplex "TG" Insert Venturi Tubes.

SIMPLEX VALVE & METER COMPANY
6780 UPLAND STREET, PHILADELPHIA 42, PA.



Servicing Draft Fans with reduced maintenance crews



The FAN is the heart of any AIR system. In the Power Plant, Buffalo Forced and Induced Draft Fans mean the system is always up to par.

Many a Chief, turning grey from trying to keep the power plant at peak operation with war-reduced maintenance crews, is thankful that Buffalo power plant fans are built so you can "take em apart."

To build fans which are easy to assemble and disassemble takes more detail drawings, more hours of work in the shop, sometimes heavier gauges in certain parts of the housing.

On the job, these extra hours "pay off" to the operators. When short-handed crews replace a rotor, or reblade one, the convenience with which Buffalo fans can be dismantled is most welcome.

And considering that Buffalo Fans cost no more, and deliver the air at peak efficiency, it's easy to see why many of America's leading power plants use them.

BUFFALO FORGE COMPANY

488 Broadway **Buffalo, N. Y.**

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

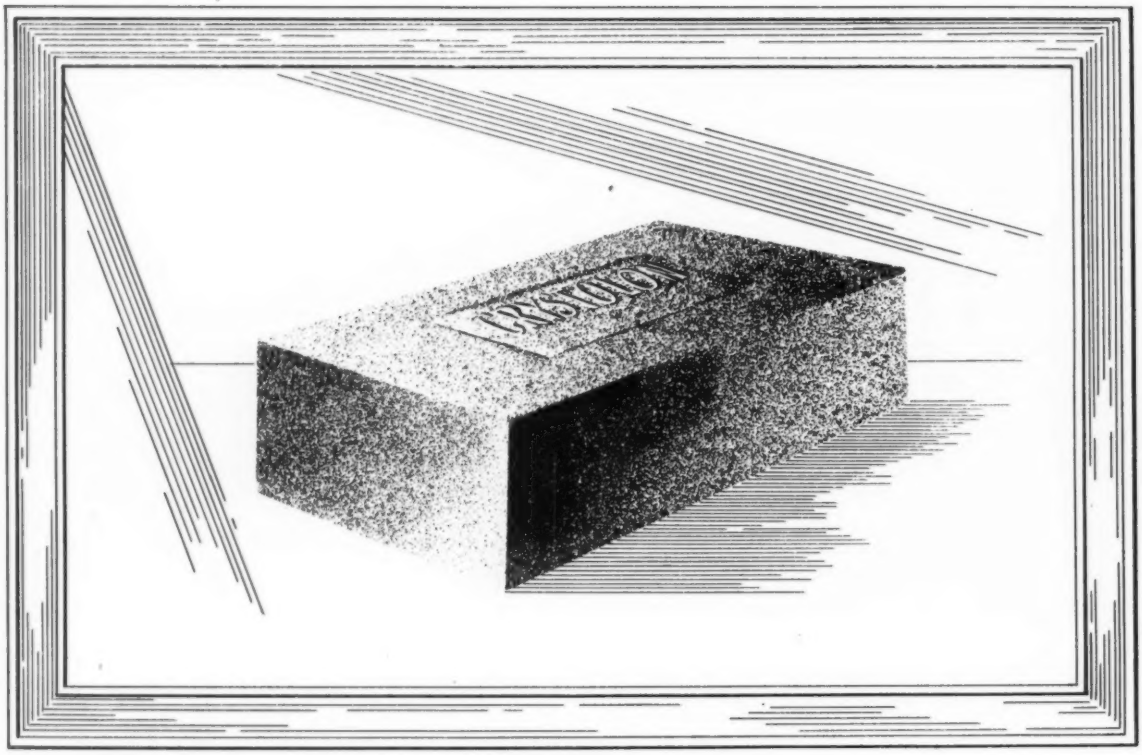
ARMY E NAVY

"Buffalo"

"First For Fans"

Forced and Induced DRAFT FANS

Portrait of a Product that didn't win the war



We cannot claim that CRYSTOLON Brick are winning that war. truthfully, all we can say is that these brick are made to give long service, and our customers report that they are doing so.

CRYSTOLON Brick are densely made of highest grade silicon carbide with a minimum of bond and fired at high temperatures. Their dense surface resists slag penetration. This means that clinkers are easily removed leaving the bricks clean and undamaged. These brick have great strength at elevated temperatures and their resistance to spalling is greater than that of any other commercial refractory material. Because of the extrem hardness of silicon carbide, these brick have remarkable resistance to abrasion.

Along the clinker line of boiler furnaces and at those points where wear and tear are severe CRYSTOLON Brick stand up best. They eliminate wasteful "down time" for lining repairs when peak operation is needed. They reduce maintenance costs at all times.

NORTON COMPANY **Worcester 6, Mass.**

Norton Longer Lasting Refractories

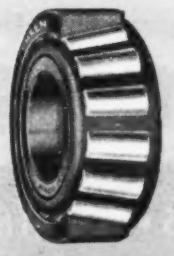
SAVING POWER IN CRANE OPERATION

5TH WAR LOAN

"Buy more — double what you did before."

An ingenious use of Dodge-Timken Pillow Blocks is illustrated in this crane photograph. Inverted pillow blocks are shown supporting the crane bridge wheels; other pillow blocks installed in the orthodox position, are used to support shafts forming part of the driving mechanism; one of the units can be seen at the extreme left.

Besides providing adequate support for the members to which they are applied, Dodge-Timken Pillow Blocks eliminate friction; simplify lubrication; give complete protection against radial, thrust and combined loads; and hold moving parts in correct and constant alignment.

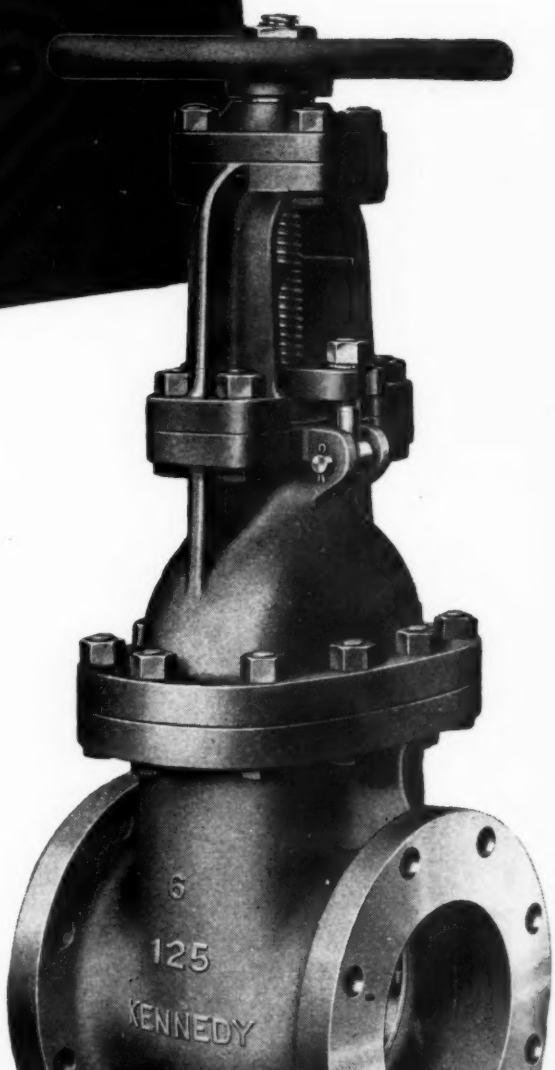


They thus save power and lubricant; increase endurance; and reduce maintenance wherever they are used. The Timken Roller Bearing Company, Canton 6, Ohio.

TIMKEN
TAPERED ROLLER BEARINGS

OUTSTANDING VALVE SERVICE

Discs that seat tight, operating mechanisms that open and close the valve easily, stuffing boxes that are amply deep and conveniently repacked, bodies with an ample margin of strength, precision machine work throughout . . . all these factors that provide OUTSTANDING VALVE SERVICE are found in every KENNEDY Valve. Write for Catalog 63 describing these Kennedy Valve characteristics in detail.



Kennedy Iron Body Wedge Gate and Double Disc Gate Valves are also built for pressures up to 250-lb. steam and 500-lb. water.

Fig. 0611 KENNEDY Standard Iron Body Wedge Gate Valve with outside Screw and Yoke

KENNEDY VALVES • PIPE FITTINGS • FIRE HYDRANTS
THE KENNEDY VALVE MFG. CO. • ELMIRA, N.Y.

New!

A BOILER RATIO METER by COCHRANE

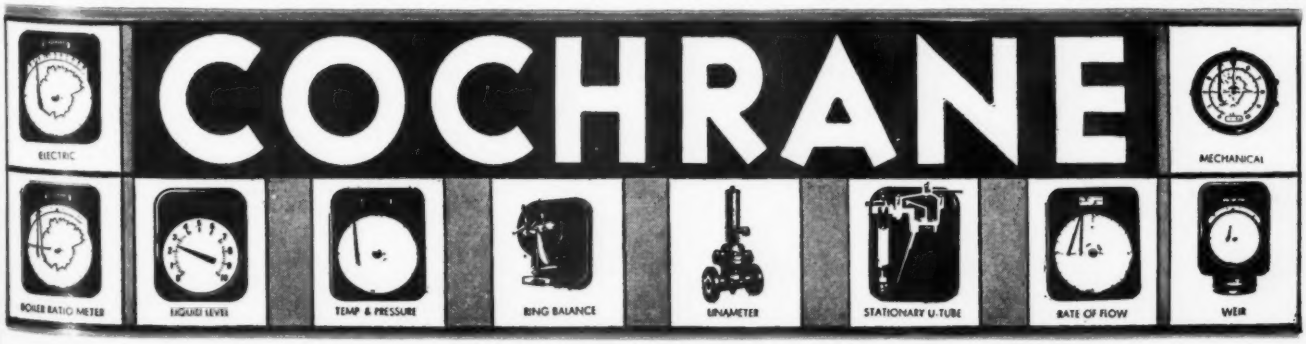
A Red indication pointer operating across a white 10" scale makes it unnecessary to examine closely the position of the pens to determine whether the air is excessive or insufficient, for the movement of the pointer is 3 times as great as the difference between the pens.

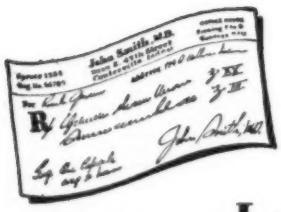
THE Cochrane Corporation offers to the power plant field a new boiler meter of the steam-flow, air-flow type known as the Cochrane Boiler Ratio Meter. This meter has several important advantages over other constructions. An easily adjustable cam in the air flow mechanism permits the operator to establish the relation of air supply to fuel supply (measured by steam generated) most favorable for his particular operation. The ratio indicating pointer, illustrated and described above, is another feature. The steam flow mechanism is the well-known Cochrane Friction-Free Electric Flow Meter, operating on the null balance principle assuring highest accuracy, while the air flow mechanism is based on the highly responsive Hays slack diaphragm, equipped with an electric motor follow-up for ample power. Intelligent use of the Cochrane Boiler Ratio Meter will result in lower operation and maintenance costs as well as greater plant capacity without increasing the size of the steam producing units or auxiliaries.

Write NOW for a copy of Publication 4071, "Double-Barreled Combustion Guidance"

COCHRANE CORPORATION
3106 N. 17th St., PHILADELPHIA 32, PA.

THE MOST COMPLETE LINE OF FLOW MEASURING INSTRUMENTS





Let us prescribe

for your "sick" heating system

Here's a remedy for many poorly heated commercial, industrial and institutional buildings... A good way to correct waste of valuable rationed fuel... A good way to assure even room temperature throughout your building.

Convert your obsolete steam heating system into an economical and controllable Webster System... One that assures balanced distribution of steam to every radiator—regardless of distance from the boiler.

With the Webster Moderator System of Steam Heating, there is no waste of rationed fuel through overheating. Webster "Control-by-the-Weather" automatically changes the heating rate to agree with changes in outdoor temperatures.

More Heat with Less Fuel

Webster Engineers surveyed thousands of buildings to give owners an accurate estimate of the extra heat per unit of fuel to be achieved with the Webster Heating Modernization Program. They found that seven out of ten large buildings (many less than ten years old) can get up to 33 per cent more heat from the fuel consumed.

Let us show you how to obtain more heat from your rationed fuel. Write for "Performance Facts". This free booklet contains case studies of 268 modern steam heating installations in medium to large size buildings. Shows dollars and cents savings. Dept. P-6

WARREN WEBSTER & CO., Camden, N. J.
Pioneers of the Vacuum System of Steam Heating :: Est. 1888
Representatives in principal cities :: Darling Bros., Ltd., Montreal

ARMY (E) NAVY
Making Boosters for U.S. Army Ordnance

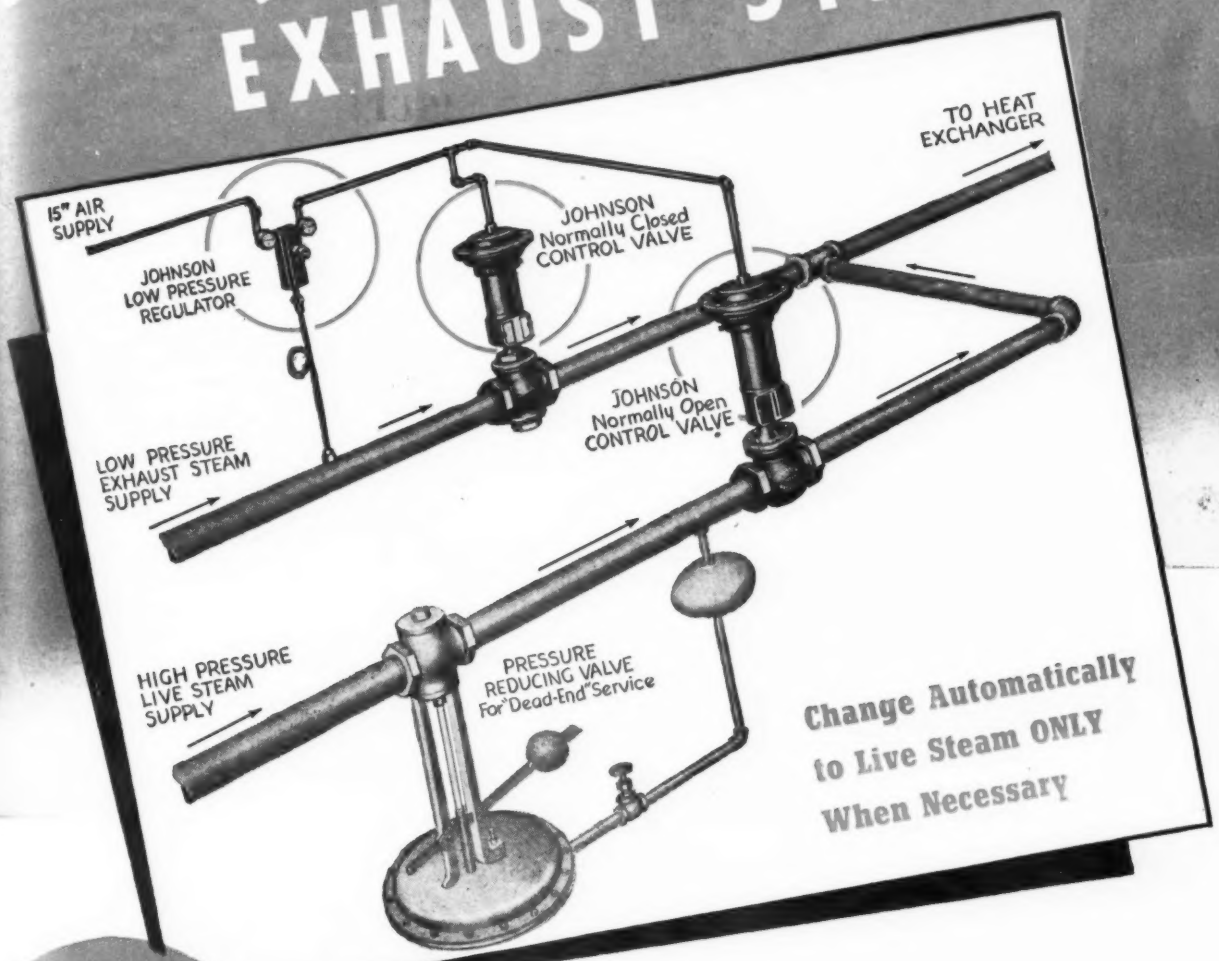
Webster
Steam Heating

Outdoor Thermostat

Manual Variator

In the Webster Moderator System of Steam Heating there are just four control elements—an Outdoor Thermostat, a Main Steam Control Valve, a manual Variator and a pressure control Cabinet. These controls are an integral part of the Webster System . . . assuring the highest expression of comfort and economy in modern steam heating.

Utilize EXHAUST STEAM


15" AIR SUPPLY
JOHNSON LOW PRESSURE REGULATOR
JOHNSON Normally Closed CONTROL VALVE
TO HEAT EXCHANGER
JOHNSON Normally Open CONTROL VALVE
LOW PRESSURE EXHAUST STEAM SUPPLY
HIGH PRESSURE LIVE STEAM SUPPLY
PRESSURE REDUCING VALVE For "Dead-End" Service
Change Automatically to Live Steam ONLY When Necessary

ANOTHER PROBLEM SOLVED BY JOHNSON CONTROL

Conserve wartime fuel! Save steam! Save money! Utilize economical *exhaust steam,* whenever possible. . . . The Johnson control hookup, illustrated above, overcomes the principal disadvantage of using exhaust steam for heating coils, heat exchangers and other equipment where low pressure steam is required. When the pressure of the exhaust steam drops to a point where it ceases to be useful, the Johnson "Low Pressure Regulator" closes the Johnson Valve on the exhaust steam supply and opens the Johnson Valve on the live steam supply. A "dead-end" reducing valve is set to deliver live steam at proper pressure. Automatically, without attention of any sort, exhaust steam is used whenever it is available. Live steam "comes to the rescue," only when needed. There is no chance for the lack of proper steam pressure to be overlooked. . . . Another problem solved by Johnson control! Send for bulletins describing Johnson apparatus or ask to see a Johnson engineer from a nearby branch office—no obligation, of course.

JOHNSON

Fuel-Saving Starts With CONTROL

Automatic TEMPERATURE AND AIR CONDITIONING *Control*

JOHNSON SERVICE COMPANY, MILWAUKEE 2, WISCONSIN • DIRECT BRANCHES IN ALL PRINCIPAL CITIES

FOR EVERY *Central Station* REQUIREMENT

● Designed specially to meet the most exacting requirements,– Bartlett-Snow central station coal handling equipment is adapted to receiving coal by rail,– over waterways,– or by truck . . . and to storing and reclaiming the coal. The systems handle run-of-mine or crushed coal,– or permit crushing of the coal during its travel from the receiving point to the stoker or pulverizes.

Complete facilities are available, including receiving hoppers–belt, apron, reciprocating and duplex reciprocating feeders – belt conveyors and belt trippers – crushers – skip hoists, which are coming into increased favor in places where ground space is limited and lift is high – bins and bunkers – weigh larries – power driven or manually operated larry cars – distributing flight conveyors (hooded and vented to a dust collector if desired). The equipment can be partially exposed to view from outside the building,– or wholly enclosed permitting the building to conform to any architectural style.

Bartlett-Snow offers long and specialized experience – proven design – and the advantage of fixed, undivided responsibility that gives positive assurance of the efficient and satisfactory operation of the entire system as a unit. Bulletin No. 83 gives full details,– and contains much information of interest to plant engineers and operating men. Send for a copy.

THE C. O. BARTLETT & SNOW CO.

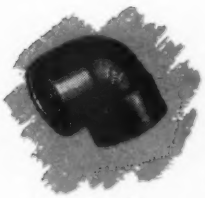
6205 HARVARD AVENUE • CLEVELAND 5, OHIO

Engineering and Sales Representatives in Principal Cities

COAL HANDLING FOR CENTRAL STATIONS AND INDUSTRIAL BOILER PLANTS

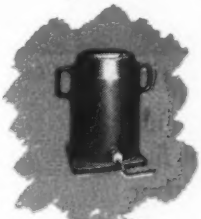
TRACK HOPPERS • SKIP HOISTS • BUCKET ELEVATORS • BELT CONVEYORS
BINS AND BUNKERS • WEIGH LARRIES • FIELD STORAGE • ASH HANDLING

5 ways to get EXTRA SERVICE at NO EXTRA COST... USE THESE W-S PRODUCTS



FORGED STEEL FITTINGS—Forged Steel Screw End and Socket Welding Pipe Fittings are made by Watson-Stillman in a full line of Elbows, Tees, Crosses, Laterals, Couplings, Reducers, Bushings, Caps, Plugs and Unions for standard, extra-heavy and double extra-heavy pipe lines. All W-S Fittings have uniform wall thickness, maximum wall strength and conform to rigid material specifications. Ask for Bulletin A-3.

VALVES—For use on standard, extra-heavy and double extra-heavy pipe lines, Watson-Stillman supplies bronze or forged steel Globe Valves, Angle Valves, Needle Valves and Check Valves in a wide range of sizes, for screwed, socket welding and flanged connections. Ask for Bulletin A-4.



HYDRAULIC JACKS — Watson-Stillman builds standard hydraulic jacks in Independent Pump, Vertical Attached Pump, and Horizontal Attached Pump types. Capacities of 10 to 500 tons. Ask for Bulletin 710-A.

HAND PUMPS — For operating jacks, small hydraulic tools, and general hydrostatic testing purposes, Watson-Stillman manufactures Single Plunger and Double Plunger Hand Pumps with large, medium and small tanks. Ask for Bulletin 240-A.

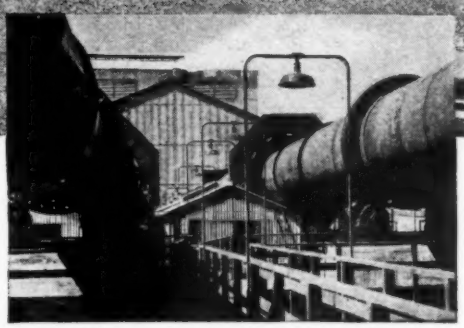
WIRE ROPE SHEARS—On all sorts of construction and maintenance jobs, Watson-Stillman Wire Rope Shears are time-saving equipment. Also suitable for cutting iron bars and rods. Ask for Bulletin A-6 Edition 3.

The Watson-Stillman Company, Roselle, N. J.

WATSON-STILLMAN

Distributor Products Division

DESIGNERS AND MANUFACTURERS OF FORGED STEEL FITTINGS, VALVES AND HYDRAULIC EQUIPMENT



Austin Company — Architect, Engineer, Manager

K&M "Century" Asbestos-Corrugated and Flat Sheet Material is available now

Approximately 15,000 tons of K&M "Century" Asbestos-Corrugated Roofing and Siding have been used in the plants of this company . . . one of the largest magnesium producers in America. From these plants come much of the magnesium responsible for many of America's wartime achievements. This metal holds still greater promise for the peacetime years ahead. That's why the manufacturer chose K&M "Century" . . . noted for its permanence and low maintenance cost.

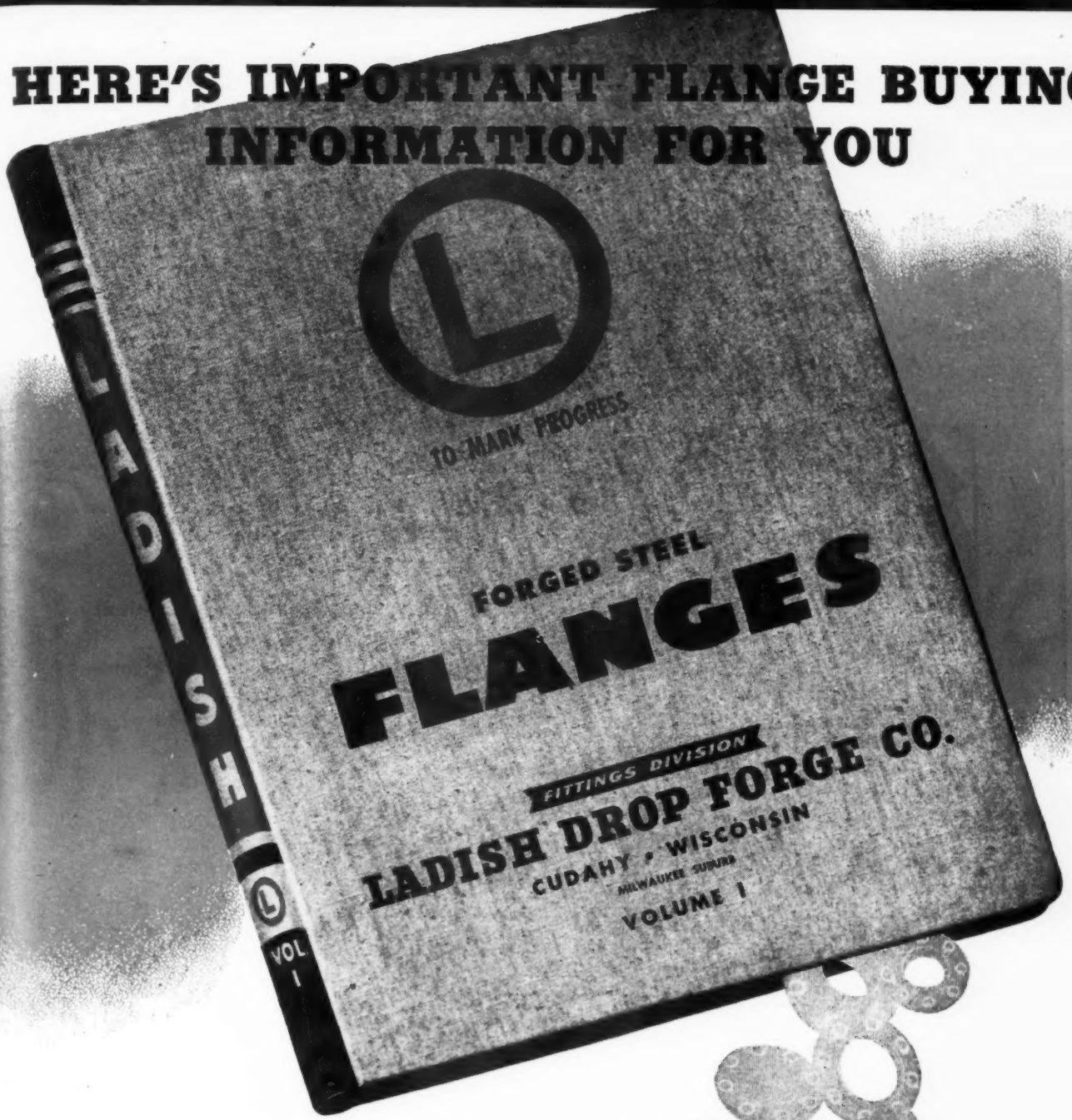
K&M "Century" Asbestos-Corrugated and Flat Structural Sheet Material offers *you* definite savings in building costs and maintenance costs. It is highly resistant to fire, corrosion and all kinds of weather. It combines the best qualities of two great building materials—asbestos and Portland cement.

K&M "Century" Corrugated Sheets in nineteen different sizes speed up construction, and its light gray color is pleasing and permanent. *It never needs paint for protection!* If your plans for plant expansion involve special problems, let Keasbey & Mattison, through its approved distributors, help you solve them with "Century" Asbestos-Corrugated and Flat Sheet Material.

Our Ambler plants proudly fly the Army-Navy "E" flag with its star—an honor awarded K&M employees "for continued outstanding production of war materials."

KEASBEY & MATTISON
COMPANY • AMBLER • PENNSYLVANIA

HERE'S IMPORTANT FLANGE BUYING INFORMATION FOR YOU



The New Catalog of the Ladish Fittings Division Describes the *Complete* Line of Ladish Forged Steel Flanges

Your copy of this catalog contains complete descriptions, prices and specifications of the full line of Ladish *Controlled Quality* Forged Steel Flanges . . . the distinctive green colored flanges that are being used in piping systems now.

Purchasing Agents, Engineers and Specification Writers will find this Ladish Catalog a most valuable reference. Write for your copy today.

ARMY NAVY

TO MARK PROGRESS

FITTINGS DIVISION

LADISH DROP FORGE CO.

CUDAHY • WISCONSIN

MILWAUKEE SUBURB

Retubing and Repacking are *EASY*

with

JOHN CRANE
CONDENSER PACKING

- Quickly and easily installed — with simple, inexpensive tools.
- Seals tubes quickly and positively; no adjustment required; high vacuum maintained.
- Eliminates ferrules; no necking of tubes.
- Belled inlet ends increase condenser efficiency.

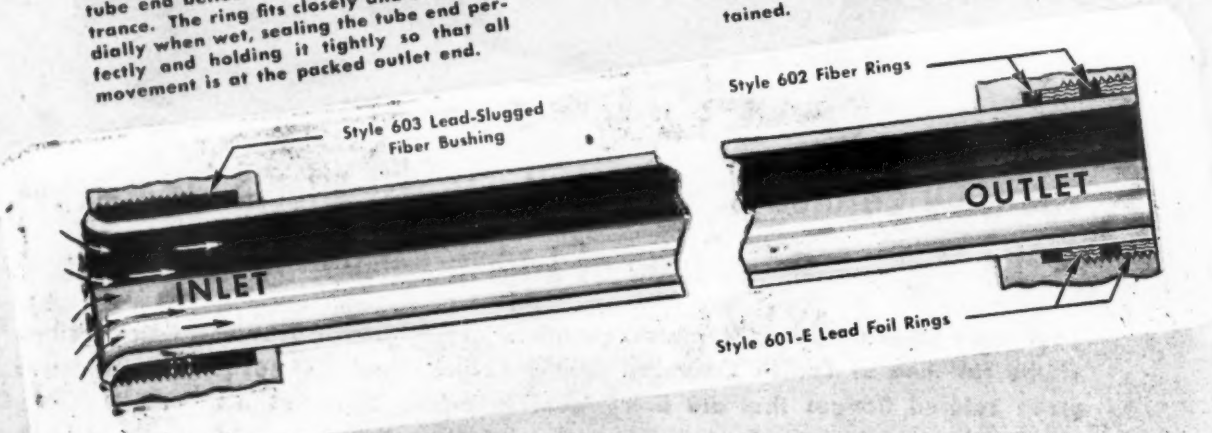
To shorten down-time and save valuable man-hours, use the John Crane Packing Method—the easiest, quickest, most economical method of all.

Inlet End

The Inlet End of the tube may already be rolled into the tube sheet. If not, the same effect is obtained by using a Style 603 Lead-Slugged Fiber Bushing driven into the stuffing box as shown below, with the tube end belled to make a "Venturi" entrance. The ring fits closely and swells radially when wet, sealing the tube end perfectly and holding it tightly so that all movement is at the packed outlet end.

Outlet End

The Outlet End of the tube is packed with a set of metallic and fiber rings as shown below. The soft lead foil rings flow into and fill the threads, while the fiber rings fit closely and swell radially when wet. The tube is free to expand and contract at the outlet end, yet a tight seal is maintained.



Ask your friends who have used John Crane Condenser Tube Packing—they will tell you it costs less in the long run, is easier to install and improves over-all condenser efficiency. Then write for our Engineering Recommendations.

Buy More War Bonds

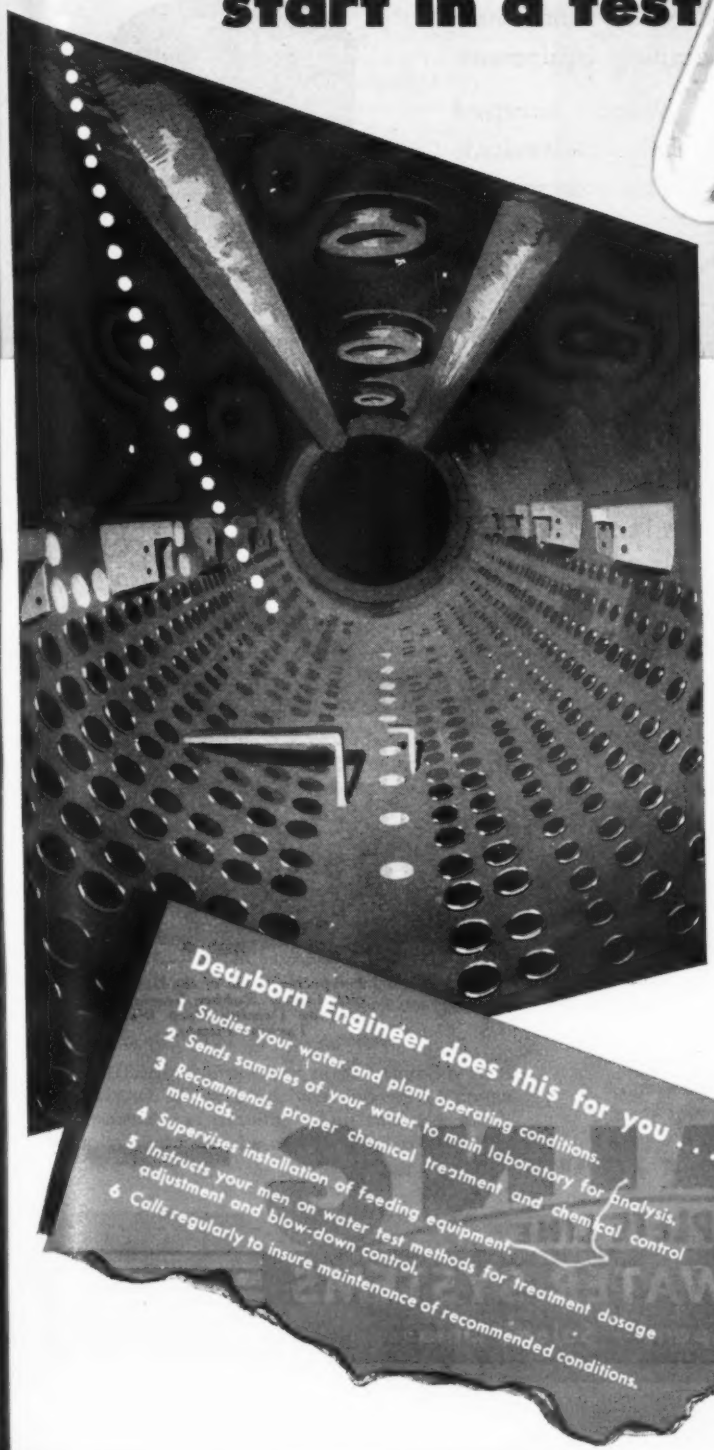
CRANE PACKING COMPANY

1811 CUYLER AVE. • CHICAGO 13, ILL.

BALTIMORE, BOSTON, BUFFALO, CLEVELAND, DALLAS, DETROIT, HOUSTON, LOS ANGELES, NEW ORLEANS, NEW YORK, PHILADELPHIA, PITTSBURGH, SAN FRANCISCO, ST. LOUIS, TULSA

CRANE PACKING CO., LTD., Hamilton, Ontario, Canada. Branches: Montreal, Toronto, Vancouver

scale-free boiler tubes start in a test tube


Dearborn Engineer does this for you . . .
1 Studies your water and plant operating conditions.
2 Sends samples of your water to main laboratory for analysis.
3 Recommends proper chemical treatment and chemical control methods.
4 Supervises installation of feeding equipment.
5 Instructs your men on water test methods for treatment dosage adjustment and blow-down control.
6 Calls regularly to insure maintenance of recommended conditions.

SCIENTIFIC analysis of your water supply by the Dearborn laboratory and a thorough study of your operating conditions by Dearborn engineers is the beginning of the Dearborn treatment method.

Analyze all conditions first then treat the water with special Dearborn reagents. Control the feed by systematic check-up and your boilers will be maintained in full steaming condition to carry the extra loads demanded these days. Over 8000 plants using this service will certify boilers *remain* scale-free. Protection against pitting and corrosion is accomplished by this treatment.

The Dearborn engineer in your vicinity knows local water characteristics. He'll be glad to help you solve your boiler water problems.

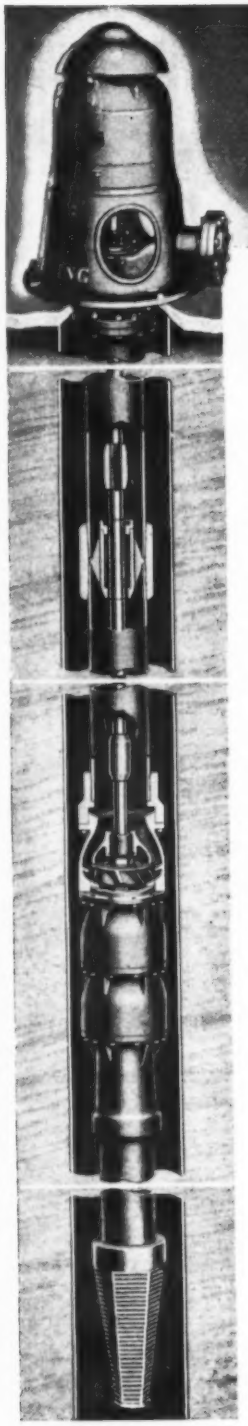
DEARBORN CHEMICAL COMPANY
Dept. D, 310 S. Michigan Ave., Chicago 4, Ill.

Dearborn
TRADE MARK REGISTERED

BOILER WATER TREATMENT AND SERVICE

Look Inside!

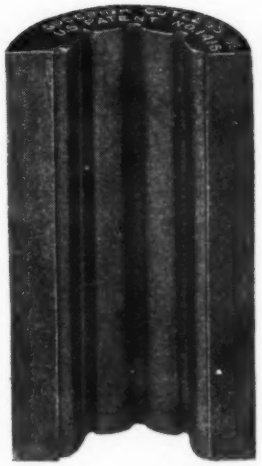
for Deming Turbine Pump Values!



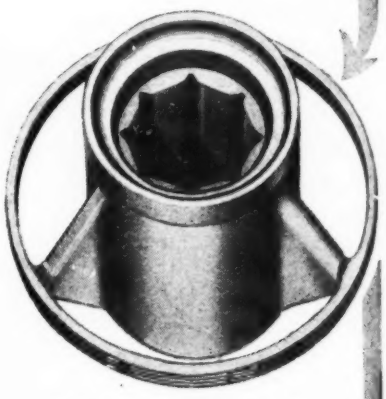
Other comparable high standards of design and construction of Deming Deep Well Turbine Pumps are fully explained in illustrated BULLETIN 4700-8. *Ask for a copy.*

The construction of Deming Deep Well Turbine Pumps is worth looking into, especially when you seek the FACTS that insure a sound investment in pumping equipment.

1. **Water Lubrication:** Water pumped from the well floods and lubricates Goodrich Cutless Rubber Bearings. This construction insures clean water supply, uncontaminated with oil or grease. The bearings are resilient and highly resistant to wear.
2. **Drive Shaft** of high grade SAE No. 1040 steel, turned, ground and polished. Fitted with built-in polished stainless steel or monel metal sleeve at bearing points.
3. **Impellers** are bronze, semi-enclosed type, dynamically balanced to insure smooth operation, and are easily adjustable for changes in well capacity and to maintain high efficiency. Impellers are locked to stainless steel pump shaft with split tapered compression sleeve and bronze lock nut.
4. **Bowls** are properly designed and carefully machined allowing the water to flow smoothly from one stage to another. Deming design insures high efficiency with consequent low power consumption and lower operating cost.



Cut-away view of a Goodrich Cutless Rubber Bearing showing the fluted design.



Perspective view of the Goodrich Cutless Rubber Bearings used on Deming Deep Well Turbine Pumps.

DEMING

THE COMPLETE LINE

PUMPS AND WATER SYSTEMS

The Deming Company · Salem, Ohio

SPEED CONTROL QUIZ

. . . a quick summary of what can be accomplished with REEVES Speed Control Units

Q. What is the range of speed variation?

A. REEVES units are available in speed variations from 2:1 to 16:1 ratios inclusive, although most installations require no more than a 4:1 range. Actual driven speeds can be secured, through reduction or increase, to provide as low as fractional r.p.m. or as high as 12,000 r.p.m.

Q. What horse power capacities?

A. Sizes from ¼ to 90 h.p.

Q. How about transmission of power—is it positive at all speeds?

A. There are countless installations of REEVES units where the slightest amount of slippage would invalidate all benefits—such as on cut-off saws, rayon spinning, etc. The answer is yes—the transmission of power is absolutely positive at all speeds.

Q. What are the torque characteristics?

A. Constant torque; power transmitted is proportionate to speed. REEVES units do not drop off sharply in h.p. at any low speeds. Constant h.p. with variable torque rated units also available.

Q. How about remote control? Operator is often at considerable distance from the drive.

A. REEVES Electric Remote Control is available with one or more push button stations, which can be located at any convenient place.

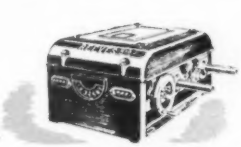
Q. Can speeds be changed automatically?

A. Yes. Actuation for automatic control can be taken from many sources, depending on material being processed. REEVES Hydraulic Automatic Control is especially suited to wide applications, being highly sensitive to change in controlled material. Pressure of only 2 or 3 ounces will produce desired changes in speed. Mechanical and differential also available. All are based on REEVES broad experience in installing automatic variable speed control.

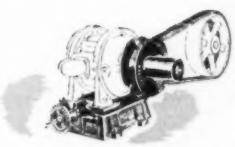
Q. Are the units easy to service?

A. Here's what one user says: "Anybody with a wrench and screw-driver can keep a REEVES Transmission running." And this user has 3 units that have been operating in his plant since 1904.

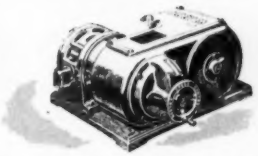
The 3 Basic Units of the REEVES *Line*



VARIABLE SPEED TRANSMISSION for providing infinite, accurate speed flexibility over wide range. Send for Catalog T-443.



VARI-SPEED MOTOR PULLEY converts any standard constant speed motor to a variable speed drive. Send for Catalog V-440.



MOTODRIVE combines motor, speed varying mechanism and reduction gears in single compact unit. Send for Catalog M-441.

• More complete information, including h.p. ratings, speed ranges, dimension tables and full description of each Basic Unit in REEVES line—is yours for the asking. Note catalogs offered above.

REEVES PULLEY COMPANY • DEPT. P • COLUMBUS, INDIANA

REEVES *Accurate Variable* **SPEED CONTROL**

VIBRATION CAUSING A "SHAKE-DOWN"?

SIMPLY APPLY UNIBESTOS
it's simple to apply!

Here's an insulation that can take hard knocks without denting or shattering—can withstand severe vibration without either sagging or gapping. Unibestos' resilient, tough fibrous construction affords outstanding structural strength.

Unibestos is available in half-section form up to 30" pipe diameter and in quarter-section form from 32" to 60", in thicknesses from ¾" to 5" . . . Single layer construction is available for service up to 1200°.

UNION ASBESTOS
MEANS PROGRESS IN INSULATION
AND RUBBER CO.

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UNION ASBESTOS AND RUBBER CO.

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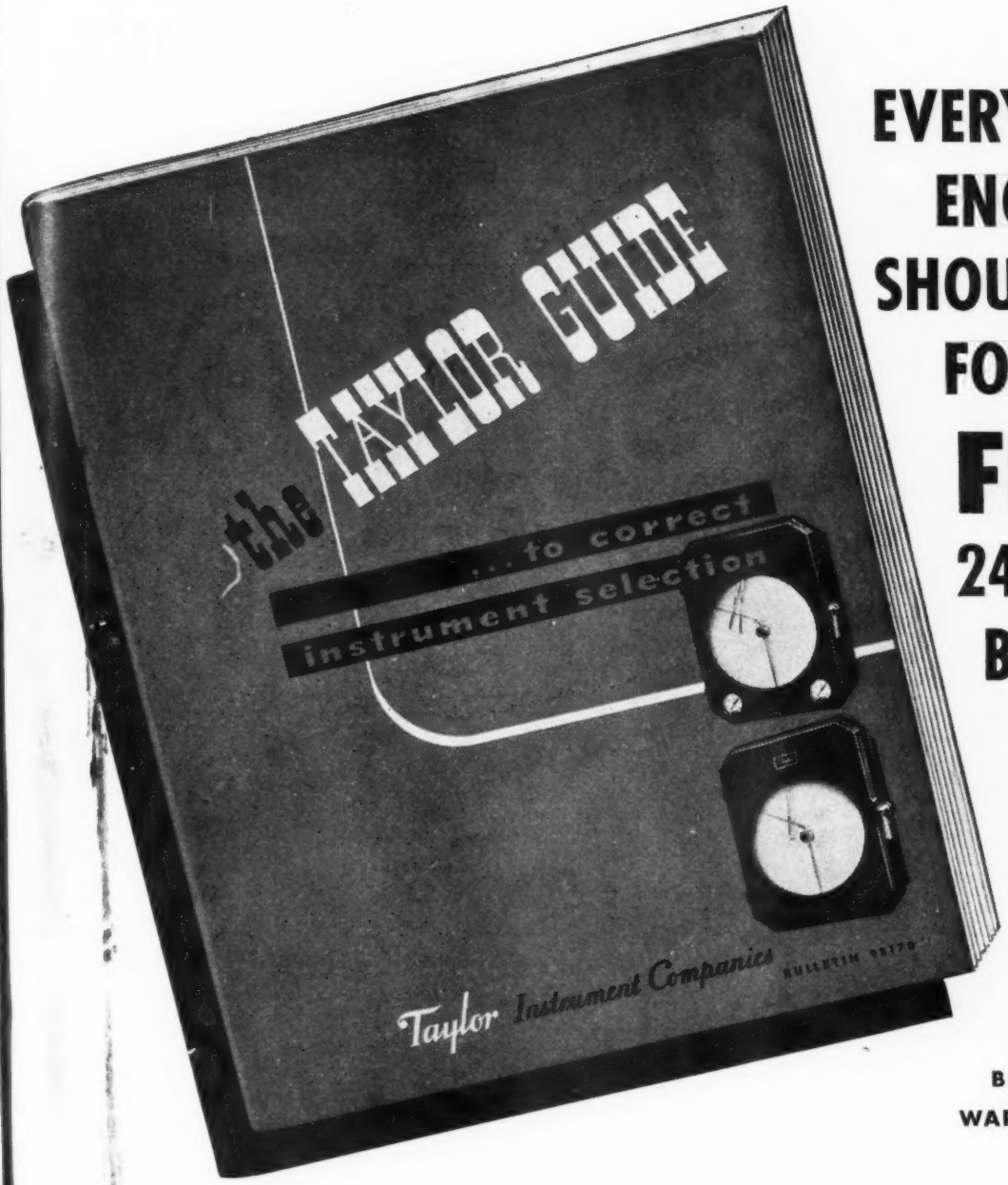


EVERY POWER ENGINEER SHOULD SEND FOR THIS FREE 24-PAGE BOOK!

BUY AN EXTRA WAR BOND TODAY!

ARE you easily confused by the conflicting recommendations of instrument manufacturers? For instance, are you relying on a mechanical type thermometer to protect a critical process when it should be further checked by a precise mercury-in-glass industrial thermometer? Are you trying to do complicated process control work with limited-purpose instruments, when there are standard special-purpose instruments to do the job *automatically?*

If so, you'll find quick answers to a lot of instrument problems in this new and different kind of guide for the whole field of indicating, recording, and controlling instruments. We've been told it's one of the best-arranged books ever assembled. It gives the uses, typical application diagrams, range limits, and the major details of all Taylor temperature, pressure, rate-of-flow, liquid level, force (or load), position, time-cycle, humidity, and special function instruments. It also shows various types of Taylor thermometers and hydrometers, and photographs of Co-ordinated Control Systems.

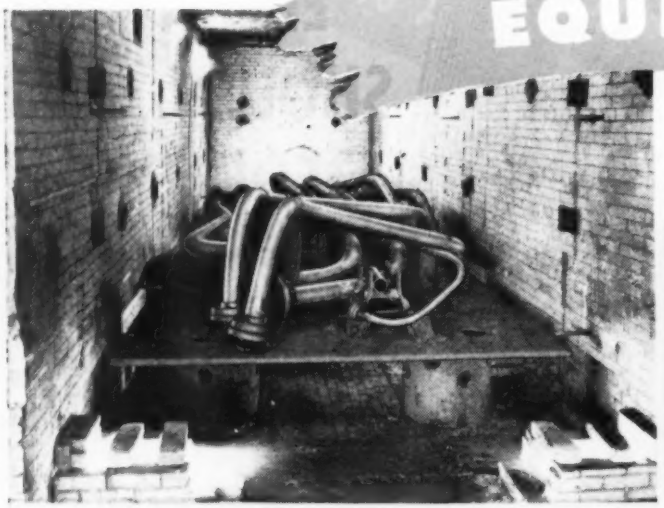
Every instrument shown in the book is backed up by 94 years of Taylor Accuracy—years spent in gaining experience through association with the leading industries of the country. Send for your free copy today! Taylor Instrument Companies, Rochester, N. Y. and Toronto, Canada. *Instruments for indicating, recording, and controlling temperature, pressure, humidity, flow, and liquid level.*

ARMY E NAVY

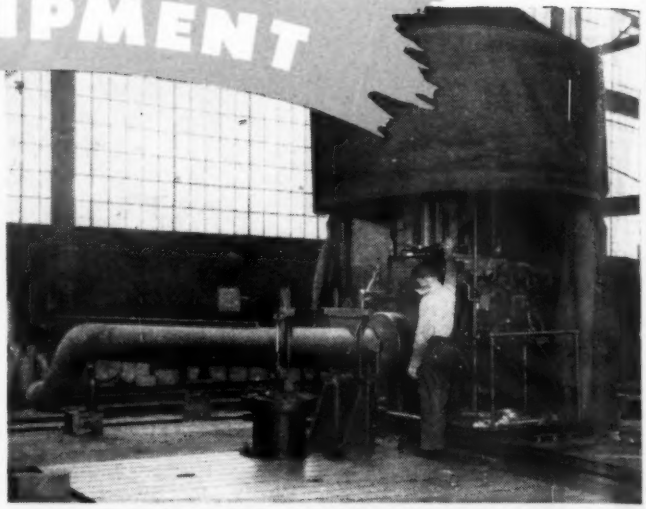
Taylor Instruments
MEAN
ACCURACY FIRST
IN HOME AND INDUSTRY

Modern Pressure Piping Requires

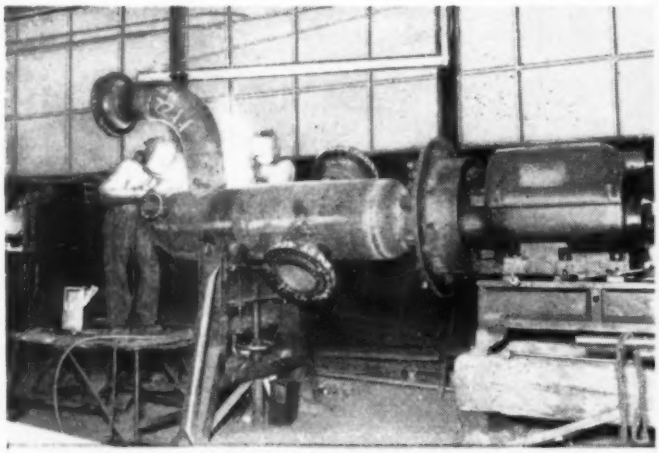
MODERN SHOP EQUIPMENT



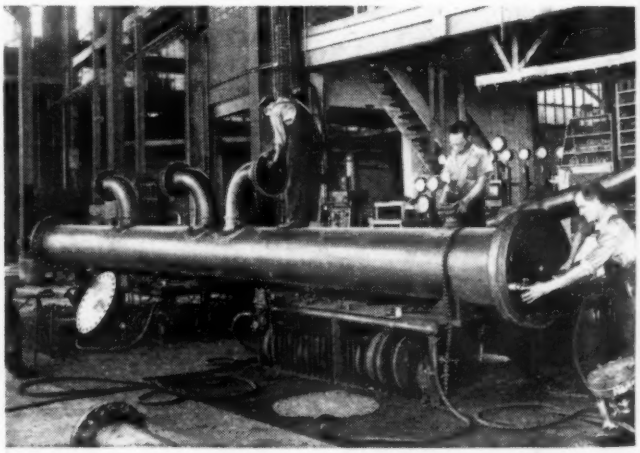
Furnace for heat treating alloy piping and for stress relieving shop-welded subassemblies.



Modern machine tools are used by the qualified fabricator for the accurate facing of pre-fabricated piping.



Special work rotating equipment permits pressure welding under the most favorable conditions.



Adequate testing equipment is another important advantage of the qualified pipe fabricator.

Knowing that "the workman is no better than his tools," qualified pipe fabricators have equipped their plants with many facilities that are not usually available in the field, but that are essential to the proper fabrication of modern pressure piping. Included are layout tables, bending equipment, form cutting machines, rotating fixtures and jigs for welding, special machine tools, preheating and stress relieving equipment, straightening tables, special testing equipment, etc. These facilities represent an enormous investment and are necessary to assure the high quality, speed, economy and easy installation of pre-fabricated pressure piping.

Pre-fabricated piping is delivered to the job as a series of subassemblies with all difficult operations performed. These subassemblies are commercially practical, heat treated and stress relieved when necessary, shop tested, accurately aligned, thoroughly cleaned and inspected. Erection requires a minimum of time and labor . . . the finished job is better piping.

THE PIPE FABRICATION INSTITUTE

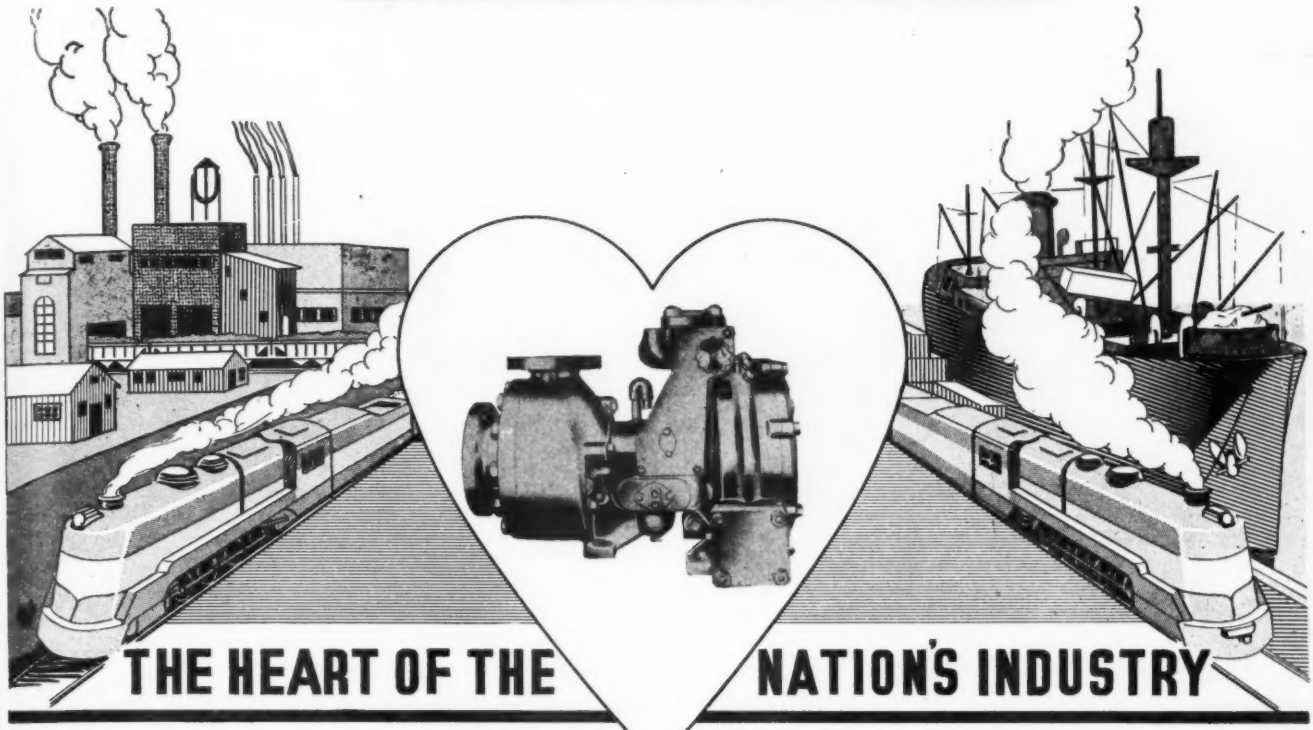
Devoted to the Technical and Economic Problems in Piping

P.F.I. THE PIPE FABRICATION INSTITUTE

G-1

1108 CLARK BUILDING • PITTSBURGH, PA

COFFIN — *Steam Turbine* CENTRIFUGAL PUMPS



INDUSTRIAL • RAILROAD • MARINE

Industry at war cannot afford to have mechanical heart trouble.

The compact, sturdy construction and long, trouble-free service of the Coffin pump is continually adding to its reputation for dependable service, On Land,—On Sea, On the Rails.

Make your next pump a Coffin pump.

RANGE—

To 500 G.P.M. Delivery
To 750 P.S.I. Pressure

Mail the Coupon

THE J. S. COFFIN, JR., COMPANY
ENGLEWOOD, NEW JERSEY

Please Send Descriptive Bulletin 1-22

NAME _____

COMPANY _____

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P.W.

NINE FOOT TWO . . . SEAMLESS . . . TRUE

Another example of Taylor Forge "know-how" that means extra value in WeldELLS

Turning out a 110" O.D. SEAMLESS Steel Flange to rigid specifications of accuracy isn't exactly the easiest job in the world. But tough jobs are not unusual here at Taylor Forge. In fact, this one is quite typical of the kind that is so often assigned to us by engineers who feel we are a little better at it than any other organization.

For a good many years these "unusual" things have been the usual at Taylor Forge . . . doing things with hot metal that nobody else does . . . knowing just how to control its flow and form under pressure and impact.

And in the final analysis there is no better example of this than your old friends WeldELLS and other Taylor Forge welding fittings themselves. For while WeldELLS represent our regular line of welding fittings, they reflect forging operations that are *far* beyond the usual!

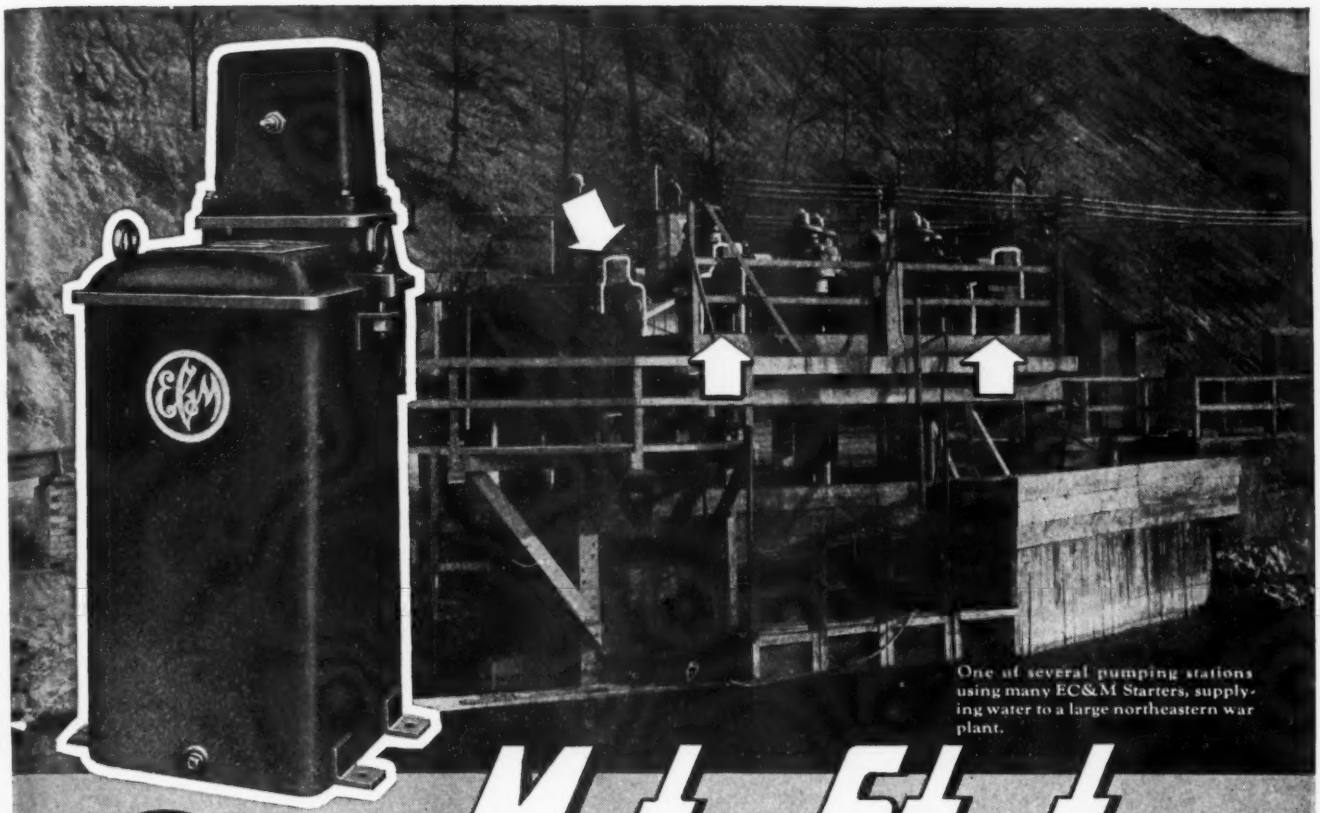
Check down the list of WeldELL features and you will see how true this is. Only Taylor Forge knowledge and methods could give you a fitting with tangents and selective distribution of metal in an extremely accurate, seamless forging! Add to this the features of WeldELLS which cut welding time and costs, and you have the fittings that . . . *"have everything"!*

No other welding fittings combine these features:

- **Seamless** — greater strength and uniformity.
- **Tangents**—keep weld away from zone of highest stress—simplify lining up.
- **Precision quarter-marked ends**—simplify layout and help insure accuracy.
- **Selective reinforcement** — provides uniform strength.
- **Permanent and complete identification marking**—saves time and eliminates errors in shop and field.
- **Wall thickness never less than specification minimum**—assures full strength and long life.
- **Machine tool beveled ends**—provides best welding surface and accurate bevel and land.
- **The most complete line of Welding Fittings and Forged Steel Flanges in the World** — insures complete service and undivided responsibility.

WeldELLS have everything

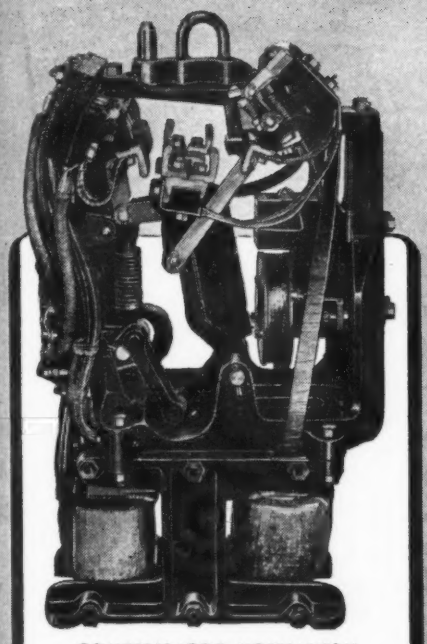
TAYLOR FORGE & PIPE WORKS, General Offices & Works: Chicago, P. O. Box 485
New York Office: 50 Church Street • Philadelphia Office: Broad Street Station Bldg.



One of several pumping stations using many EC&M Starters, supplying water to a large northeastern war plant.

REDUCED VOLTAGE Motor Starters SERVE OUTDOOR PUMPING STATION....

No Control Room Needed



COMPENSATOR MECHANISM

Single, quick-break, double-throw Contactor operated by a *single* magnet. Quick transfer from reduced voltage starting to full voltage running by a throw-over spring and a mechanical latch tripped by a current limit relay.

DAY in and day out, in the freezing winter, in the sizzling summer heat and the torrential rains—under all weather conditions—these EC&M Starters operate successfully.

They are simple, completely wired units, totally enclosed and oil-immersed in steel tanks.

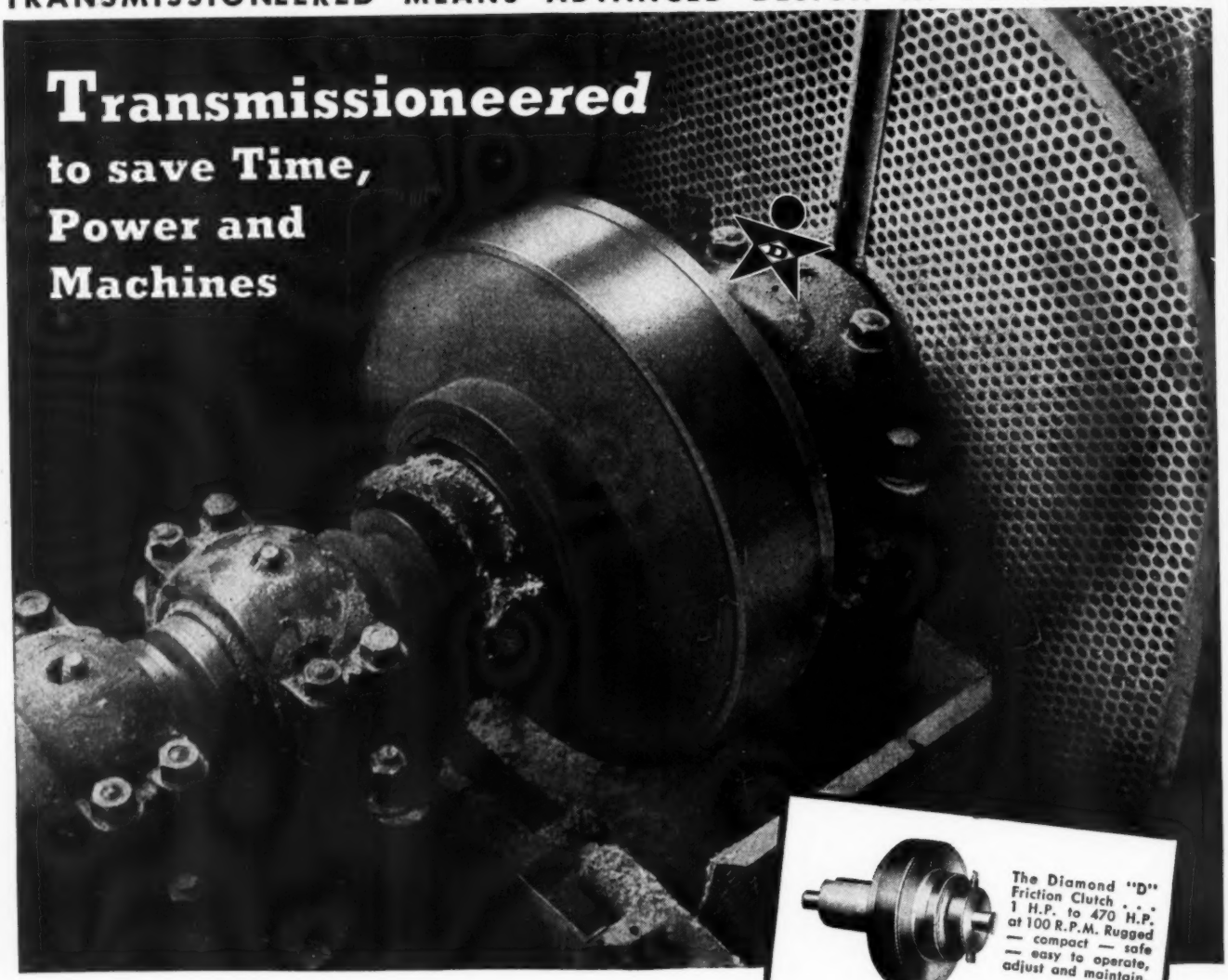
Total oil-immersion of the compensator-mechanism not only permits interrupting the circuit under oil (recognized as an effective means for breaking alternating currents), but also provides continuous lubrication for all operating parts of the mechanism and protects them from dust, moisture and corrosion.

Wherever moisture, corrosion and dust must be combated, these EC&M Starters provide fool-proof, dependable operation. *Ask for Bulletin 1045-B.*

THE ELECTRIC CONTROLLER & MFG. CO.

2700 E. 79th ST. ★ CLEVELAND 4, OHIO

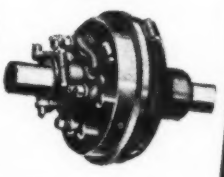
Transmissioneered
to save Time, Power and Machines



The Diamond "D" Friction Clutch . . . 1 H.P. to 470 H.P. at 100 R.P.M. Rugged — compact — safe — easy to operate, adjust and maintain.

The Dodge Solid Friction Clutch—1.3 H.P. to 50 H.P. at 100 R.P.M. Simple — rugged, powerful, easy to operate, adjust and maintain.

Dodge Rolling Grip Friction Clutch. ½ or 1 H.P. at 100 R.P.M. No toggles, fully enclosed, easy to operate, adjust and maintain. Adapted for high speed.



Dodge Split Friction Clutch. 6 H.P. to 1000 H.P. at 100 R.P.M. Split construction adapted for large, heavy slow-speed applications.

The inherent ruggedness of Dodge Clutches from ½ H.P. to 1000 H.P. capacity insures you against loss of production hours, dissipation of power and excessive wear and tear on machines.

Transmissioneering provides not only advanced design . . . it also stands for high quality of materials and workmanship as well as proper application which means the "right clutch for every job."

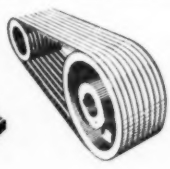
The Dodge Transmissioneer, your local distributor qualified by factory training, can help you select the right clutch for power drives or machine applications.

DODGE MANUFACTURING CORPORATION
MISHAWAKA, INDIANA, U. S. A.

DODGE

The Sign of the Dodge Transmissioneer

The Right Drive for every Job



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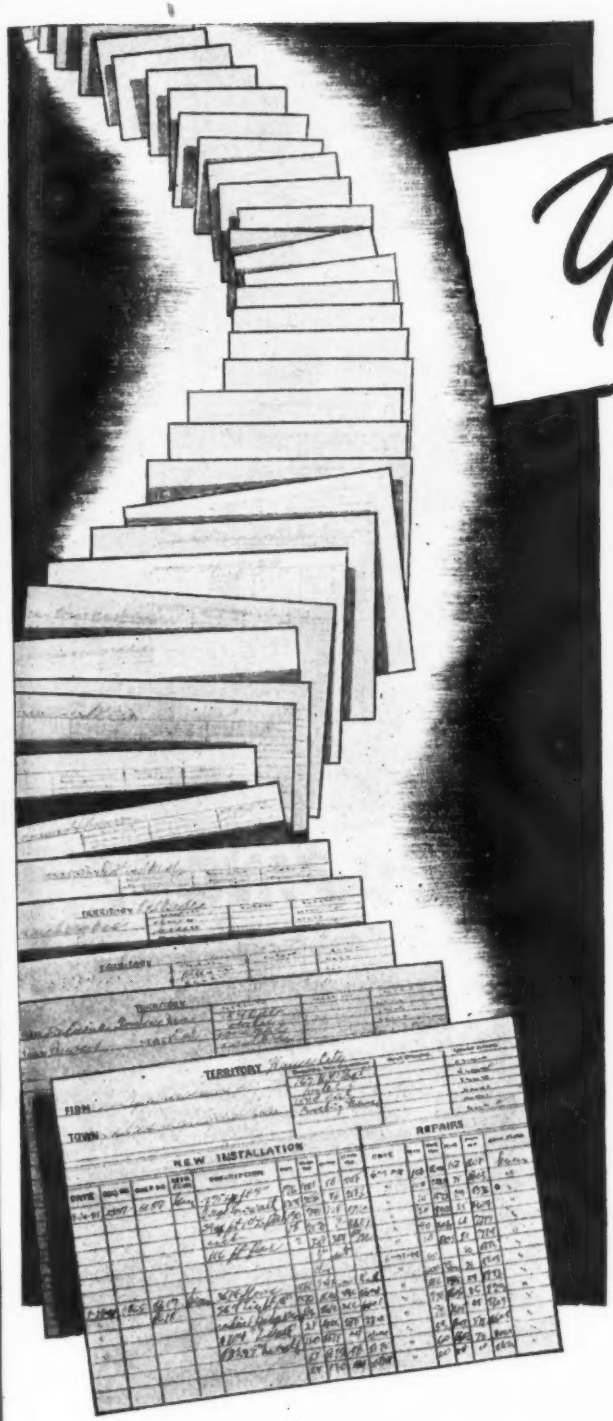

Your Name Here...*

may save you money and invaluable time

When industrial furnace enclosure repairs become necessary today, there's a lot of satisfaction in knowing that they can be made efficiently — and quickly — under the supervision of the company which designed those enclosures.

If you are fortunate enough to have Bigelow-Liptak furnace enclosures in your plant—the entire record of the installation; its description and lists of all repair parts are at the finger tips of our production department—ready to be used at a moment's call to help you get your furnace back in efficient operation in a minimum of time.

Experiences like the recent predicament of one of the major oil refineries prove the value of this Bigelow-Liptak feature. By means of comprehensive Trade Cards — that cover every Bigelow-Liptak installation from one end of the world to the other—recommendations were made over the telephone to this refinery which was having difficulties because war production during the last several years had forced operation to almost double its designed capacity. Necessary repair parts were indicated. A fully informed engineer was rushed to the job. And this aviation gasoline plant which had operated five years without repairs was back in service in four days at this greatly increased rating.

"Please accept our appreciation for the effort made to put this plant back in operation. It is nice to know we are dealing with companies and individuals who feel an interest and a responsibility in the jobs they have furnished," wrote the chief engineer of this great refinery. This is but one of dozens of recent tributes paid to the cooperation, engineering skill and efficient organization of Bigelow-Liptak.

Your operation may depend not only on the design of the heat enclosure but the cooperation and efficient organization that backs it up.

It will pay you to discuss your heat enclosure problem with Bigelow-Liptak — if you want enclosures that will give service and economy over a long continuous operating period. Get in touch with a Bigelow-Liptak engineer.

***In the general office of Bigelow-Liptak** there is a Trade Card that contains a detailed record of every installation. On this card will be found all of the data and information necessary and useful in servicing the job. Many of these cards are never referred to because Bigelow-Liptak enclosures are designed for long dependable service. But since furnace enclosures are the parts most subject to wear and tear, these records often become life savers for our customers.*

When emergencies come we can quickly refer to any customer's Trade Card and find an accurate record of any installation. In a few minutes, with the aid of this information, we can set in motion the work that will enable him to get his furnace back in service in a minimum of time. Your name on a Bigelow-Liptak Trade Card may save you money and invaluable time.

BIGELOW-LIPTAK

Unit-Suspended Walls & Arches

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DIVISION A. P. GREEN FIREBRICK CO.

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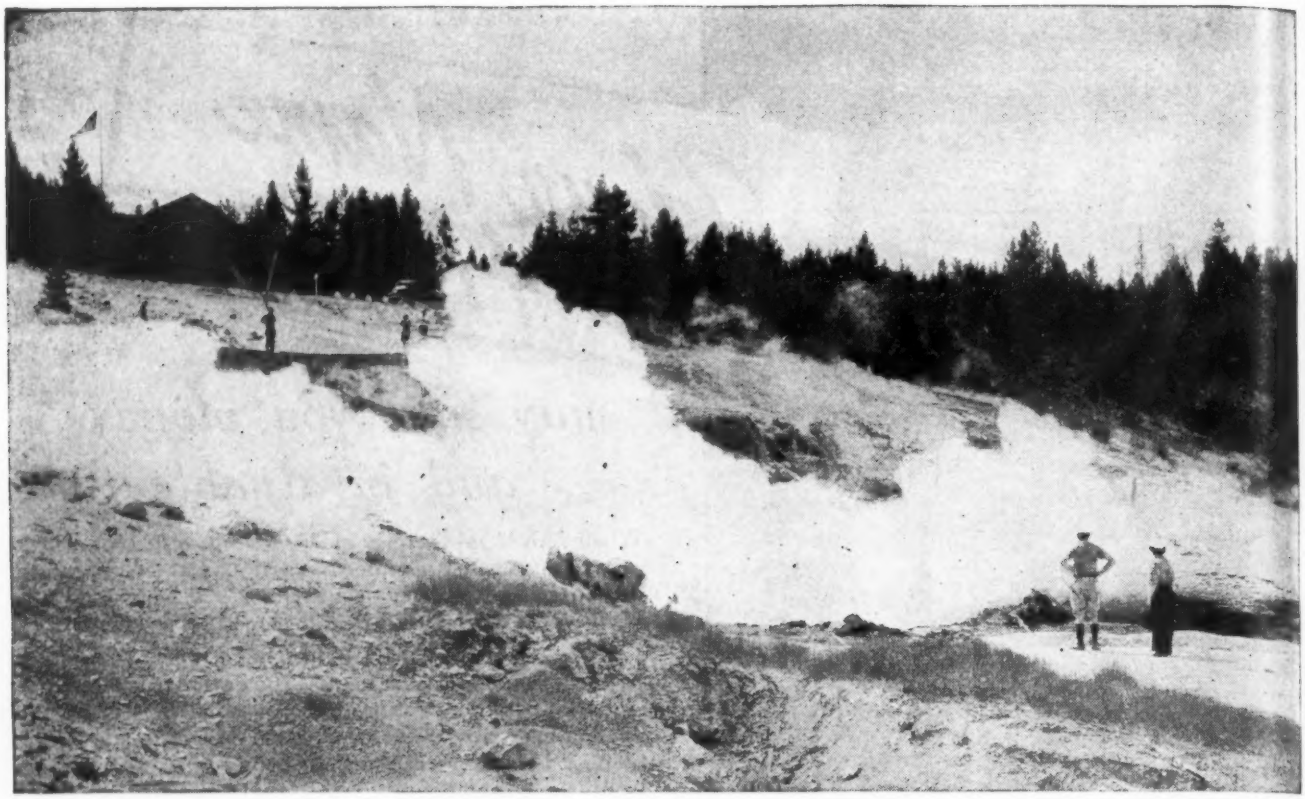
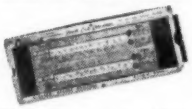


FREE STEAM IS WHERE YOU FIND IT

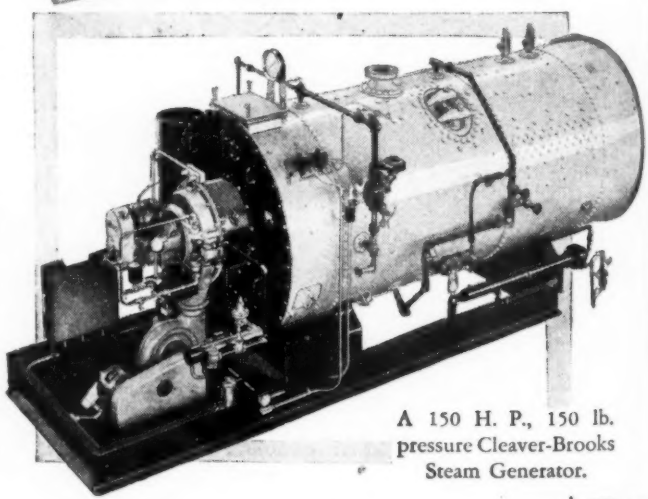
FREE steam, like gold, has to be prospected for. Some prospectors that get around the world have found it at geysers and fumaroles. One notable example of Mother Earth's steam plants is that pictured above in the Norris Geyser Basin, Yellowstone National Park, where huge quantities of steam go to waste every day. Other "prospectors" in getting around their plants have found their "free steam" in the savings made by installing steam plants of higher efficiency and lower upkeep. Cleaver-Brooks oil-fired Steam Generators have a guaranteed thermal efficiency of over 80%, and ask for a bare minimum of attention and maintenance.

The principal factor in low cost per pound of steam delivered by Cleaver-Brooks Steam Generators is their four pass down draft design which gets every possible B. T. U. out of the fuel oil before releasing the combustion gases. They are delivered in compact, self-contained units easily installed and requiring very little maintenance attention. They are clean operating—no smoke, soot, or dirt—an important factor in many industrial and commercial plants.

CLEAVER-BROOKS COMPANY
5109 N. 33rd Street **Milwaukee 9, Wisconsin**



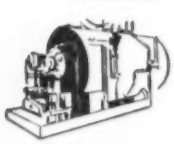
Send for our instant Steam Cost Calculator for figuring steam costs using coal or oil fuel. Yours for the asking.



A 150 H. P., 150 lb. pressure Cleaver-Brooks Steam Generator.

Cleaver-Brooks
STEAM GENERATORS

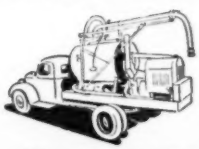
CLEAVER-BROOKS PRODUCTS INCLUDE:



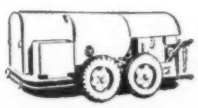
Steam Generators

Food Processing Equipment

Tank Car Heaters



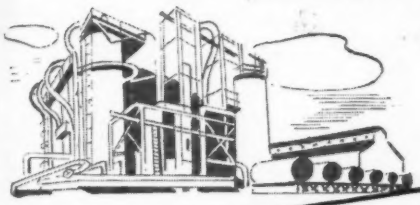
Bituminous Boosters



Special Military Equipment

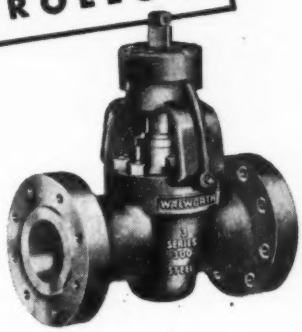
WALWORTH
LUBRICATED PLUG VALVES

recommended for "tough" services



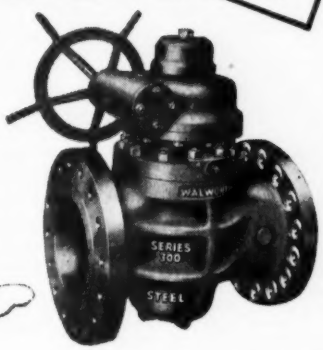
such as: Acids, Condensate, Mud, Organic Solvents, Slimes, Slurries, Vacuum and many others

PETROLEUM



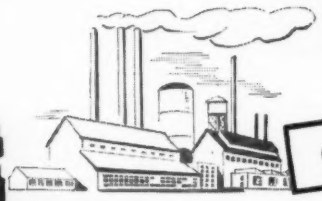
Walworth No. 1660F ball bearing type Lubricated Plug Valve is used extensively in the petroleum industry for open or closed control of "difficult" petroleum fluids. Easy operation and positive sealing is assured by selective lubrication—an exclusive feature on Walworth Lubricated Plug Valves for pressures over 1000 p.s.i.

PAPER

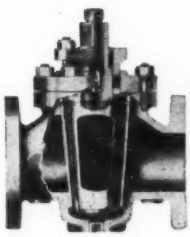


Walworth No. 1659F steel ball bearing type lubricated plug valve is used for digester blow-off service in pulp and paper manufacturing. It is worm gear operated—requires only a 90° rotation of the plug for full opening or tight closing. No gland adjustment is required. The valve may be repacked in either open or closed position.

CHEMICAL



Walworth No. 1700 is used on process lines in the chemical industry and many other industries. It is wrench operated and designed for service up to 200 lbs. o.w.g. This steeliron lubricated plug valve is available with either screwed ends (No. 1700), or with flanged ends (No. 1700F).



Just a turn of the lubricant screw on Walworth Lubricated Plug Valve forces insoluble lubricant under pressure through a grooving system and down beneath the plug. The lubricant seals the valve against leakage in either open or closed position, and also reduces friction between plug and body, thus permitting easy operation. These are some of the features which make Walworth Lubricated Plug Valves ideal for many "difficult" services.

Walworth manufactures a complete line of Lubricated Plug Valves in sizes from ½" to 24", for pressures from 125 to 5,000 p.s.i., and for vacuum requirements. These valves are all-purpose valves, but are especially recommended for difficult services.

Walworth also manufactures a complete line of valves, fittings and pipe wrenches. Walworth Catalog 42 gives detailed information. Write on your company letterhead for a free copy.

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10 Second Adjustment

to thread 1" to 2" pipe

and you cut micrometer-perfect threads with this RIDGID No. 65R

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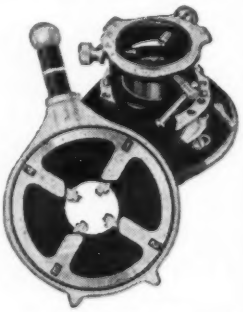

No. 65R is made in 6 models to meet your needs.

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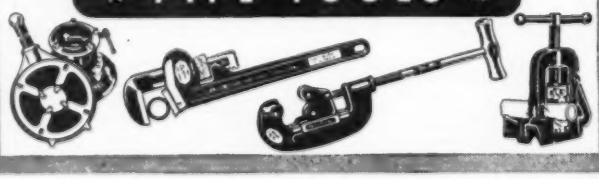
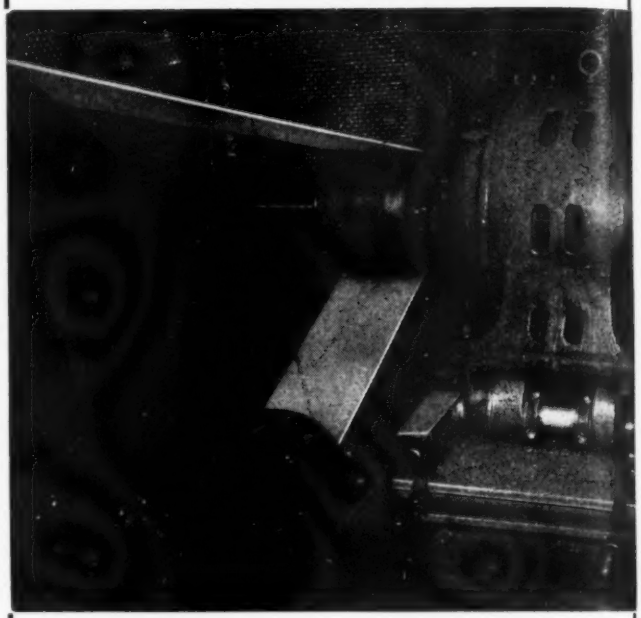


It's ECONOMICAL



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TO ASSURE MAXIMUM HANDLING EFFICIENCY

The head end of an S-A Skip Hoist handling coal in a power plant. The skip bucket is in its top position, where it can be seen discharging coal into the large storage bin.

Wherever materials handling plays such an important part in the overall operation picture, it deserves special consideration by management, and a periodic review of existing methods.

Coal handling and ash removal are operations to which Stephens-Adamson has devoted special attention through its extensive work with power plants throughout the Nation.

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November 1, 1943

Darling Valve & Manufacturing Company
Williamsport, Pennsylvania

Gentlemen:

Here's a performance report on Darcova Pumcups taken from our maintenance records. It should interest you as much as it did us.

Equipment: Worthington duplex steam pump, 12 x 5 x 12 with cast iron insert liner.

Service: Crude oil unit charging, 250-275# pressure, atmospheric temperature, corrosive service.

Average previous performance using cast iron rings:

Rings - 15 days
Pistons - 30 days
Liners - 30 days to 60 days
Rods - varying lengths of time, 30 to 90

Performance using Darcova-designed pistons and Darcova Pumcups:

Installed: September 4, 1942 along with 6" seamless steel liner, metal sprayed with hard stainless steel I.D. ground finish.

Pistons and Pumcups are still in service today, nearly 14 months later, with original liners, pistons, rods, and packing still operating. Pump efficiency increased over 25%.

Yours very truly,
Ross McClain
Ross McClain,
Master Mechanic

RM/EH

● For over forty years Darcova has been helping pump operators to save time and money and to set operating records like this.

With Darcova Pumcups the cup principle insures constant pumping efficiency. Fluid pressure keeps the Pumcup sidewall in close contact with the liner, regardless of wear. Efficiency is increased, shutdowns are fewer. Send for Bulletin No. 4105.

DARCOVA
THE ORIGINAL COMPOSITION CUP

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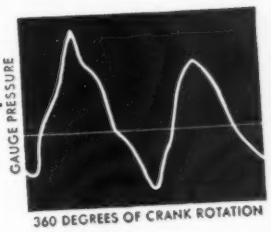
—ORIGINATORS OF SNUBBING PRINCIPLE FOR QUIETING DIESEL EXHAUSTS—BURGESS—ORIGINA

BURGESS MARINE SNUBBERS for Diesel Exhaust Noise Control

FIG. 1



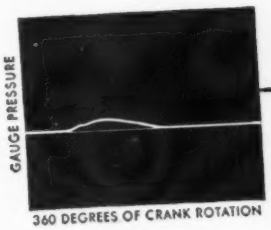
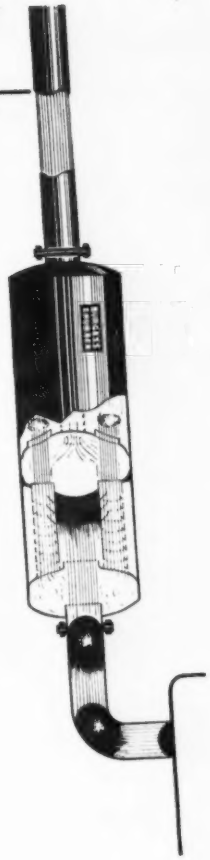


FIG. 2



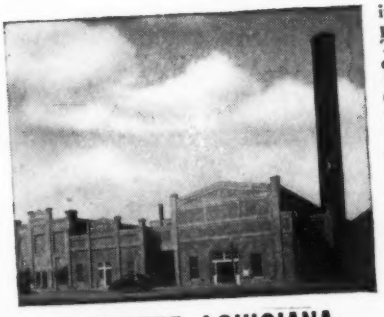
WHAT SNUBBING DOES TO A DIESEL EXHAUST

The noise of a Diesel exhaust is caused in part by the sudden expansion of slugs of gas as they are exhausted from the engine under relatively high pressure. The sudden impact of a slug of gas as it is vented to the atmosphere produces a loud concussion. These unimpaired slugs, of course, pour out of the exhaust pipe in rapid succession, and the resulting noise is deafening unless properly controlled.

A further cause of Diesel noise is the oscillation of pressure waves within the exhaust pipe. The main body of gases, traveling at high velocity, leaves the exhaust pipe with a resounding crack. Most of the gases shoot out leaving a partial vacuum in the cylinder and exhaust line. Atmospheric air flowing back into the partially evacuated pipe prevents the remaining burned gases from leaving the exhaust system. An oscillation is therefore set up which causes the characteristic Diesel exhaust roar.

In two-cycle engines, an excessive amount of burned gases may be forced back into the cylinder and cause the engine to work inefficiently. Frequently a free Diesel exhaust, unless tuned with the proper length of exhaust pipe, will interfere with scavenging. Fig. 1 shows a pressure curve of a free (unsnubbed) Diesel engine exhaust. Uncontrolled, there are wide variations of pressure. The resulting oscillations of pressure (shown by the jagged curve) create exhaust noises which are extremely disturbing.

The Burgess snubbing principle goes to the source of exhaust noise by snubbing the slugs of exhaust gases before any noise can occur. This is accomplished by spreading out the slugs and dissipating their kinetic energy before they reach the atmosphere. The slug enters the first section of the snubber—expands and loses much of its energy. Each of the remaining two snubbing sections dissipates the slugs still further so that the exhaust gases enter the atmosphere in a relatively steady flow. In addition, there can be no harmful reflected pressure surges to oscillate in the exhaust pipe to create additional noise and interfere with engine efficiency. Fig. 2 shows a pressure curve of the exhaust of the same Diesel engine when a Burgess Snubber is used. The exhaust slugs are dissipated, hence, there are no resultant noise-making surges.



LAFAYETTE, LOUISIANA, MUNICIPAL POWER PLANT

The first municipal power plant in LaFayette, La., was put into operation about 45 years ago. It consisted of two steam generating units of a combined capacity of 300 horsepower.

To keep pace with the demand of its increased population, the LaFayette power plant has grown in size and capacity. Today, four big Diesels developing a total of 4,250 hp produce a monthly output of 1,100,000 kw hrs. Two smaller Diesels of 600 hp each, purchased some years ago, are used for stand-by service.

The newer additions to the plant consist of two 1,400 hp, 8-cylinder, 16 x 20, 2-cycle, pump scavenged Fairbanks-Morse Diesels, each with a 1,000 kw generator. These F-M Diesels develop 1,400 hp at 300 rpm.

These big Diesels are quieted by Burgess Snubbers. A Burgess Air Intake Snubber is used to snub the incoming pulses of air without choking the intake pipe. This prevents the intake noise usually present with large Diesels. Loud exhaust noises are eliminated with a Burgess Exhaust Snubber by dissipating the exhaust slug before it reaches the outside atmosphere.

By using both Burgess Intake and Exhaust Snubbers, noise is eliminated without lessening the efficiency of engine operation. Such quieting of Diesel engines is provided in power plants all over the country, wherever Burgess Snubbers are used.

HELPFUL HINTS

SAI Intake Snubber

O-F Air Cleaner

DON'T OVERLOOK AN INTAKE SNUBBER AND AIR CLEANER

A Diesel engine must breathe freely. Any "choking" of the air intake impairs engine efficiency. A Burgess Snubber smooths the flow of intake air without "choking" the intake pipe.

An intake snubber should be used to smooth the flow of intake air and to level off high peak air intake velocities of pump scavenged 2-cycle engines. Otherwise oil pull-over may take place, creating additional filter maintenance problems.

Air filters require frequent servicing—at least twice a week. Care should be taken to see that the air filter is placed where servicing can be easily done.

Published by BURGESS-MANNING COMPANY Chicago, Illinois

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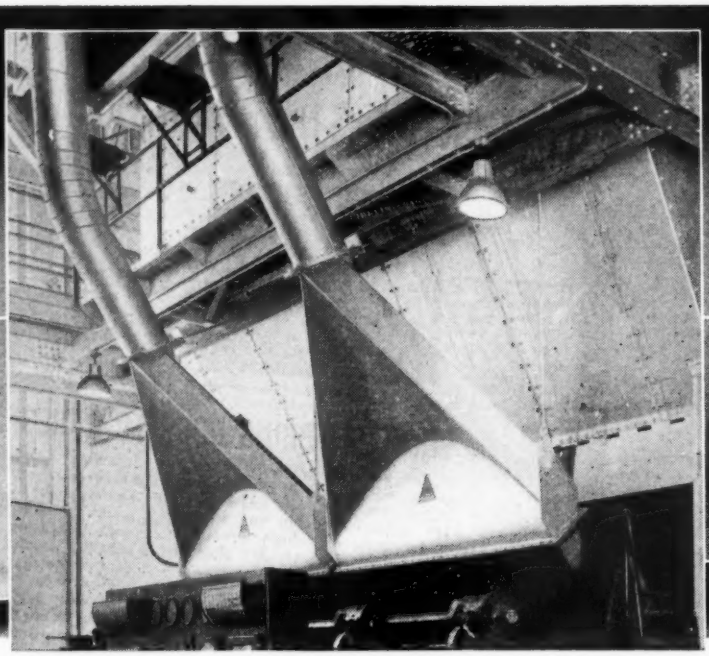

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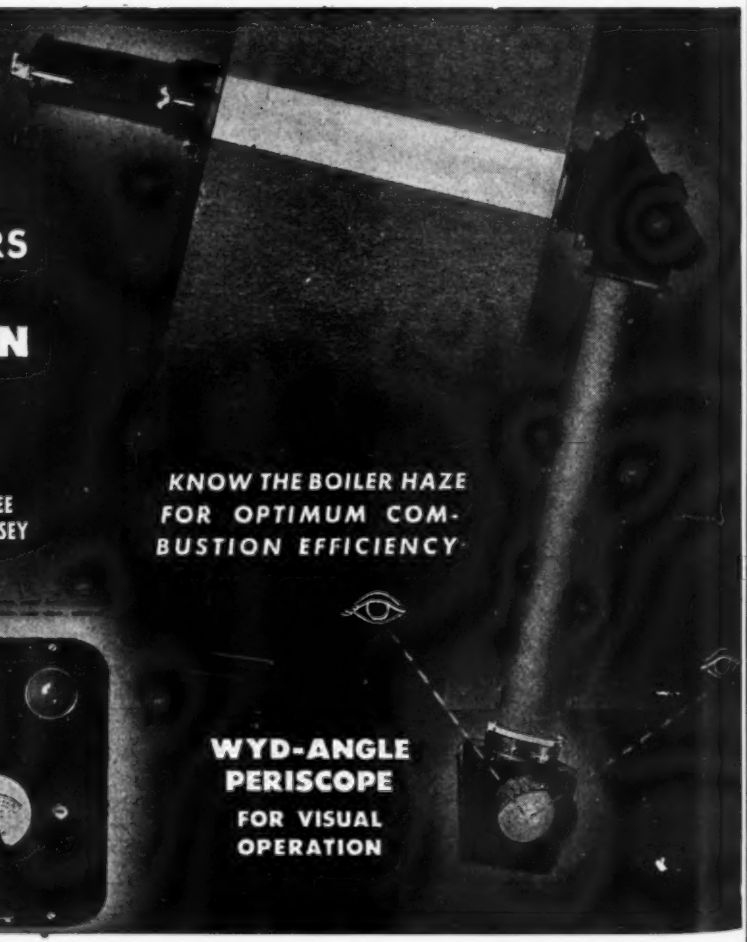

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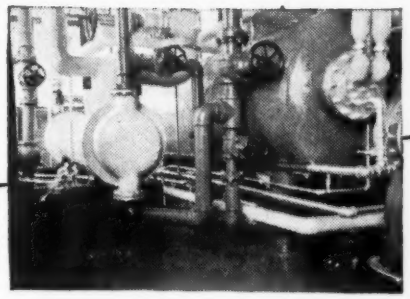
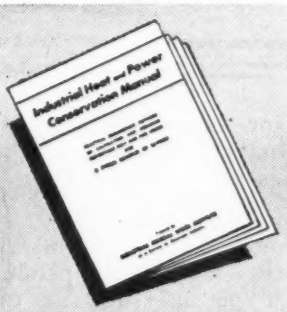
Problem—To increase efficiency of FEED WATER HEATER
Material—1½ inch blanket of Mineral Wool Insulation
Result—In one year you can

SAVE 3769 gallons of oil!





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Heat & Power Conservation Manual tells how you can Save Fuel in your plant

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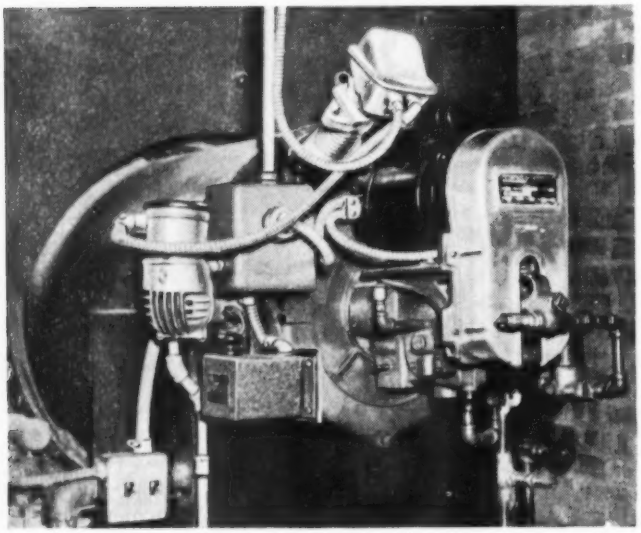
protected by WHEELCO FLAME-OTROL



In this installation both the gas and oil flames are monotored by the Flame-otrol ("Electronic Principle" Combustion safeguard). Both fuels are shut-off instantly in the event of flame failure, preventing entry of unburned fuel into the combustion chamber—the source of explosion hazard. Flame-otrols operate with equal efficiency on gas, oil, pulverized coal or any combination of these fuels. For complete information on the Wheelco Flame-otrol and its many available variations, including automatic and manual ignition, time delay for purging, and other sequences write

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Creators of "Electronic Principle" Temperature Controls.

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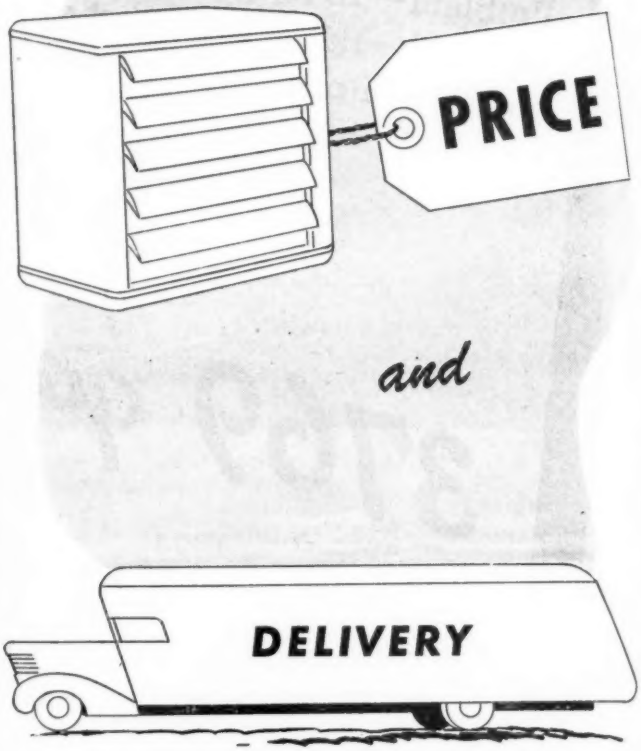

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COPPER ALLOY BULLETIN

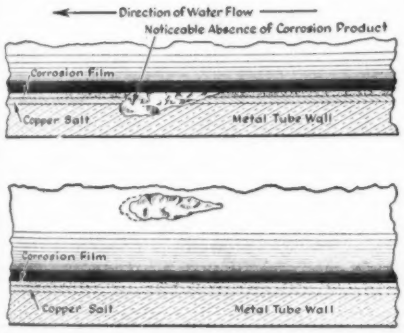
MARINE AND POWER EDITION

REPORTING NEWS AND TECHNICAL DEVELOPMENTS OF COPPER AND COPPER-BASE ALLOYS

Prepared by Bridgeport Brass Company — "Bridgeport" BRASS CO. — *Headquarters for BRASS, BRONZE, and COPPER*

Fighting Impingement Corrosion with Duronze IV Condenser Tubes

When an impinging stream of water containing air and other entrained gases attacks and wears through the protective film of a plain brass condenser tube it gains access to the underlying layer of corrosion salts. When this occurs the corrosion products are soon swept aside and the bare metal is exposed. The impinging stream then continues to aid in the removal of the metal itself producing typical almond or crescent-shaped pits under cut on one side as illustrated below.



To overcome impingement pitting, Bridgeport Brass Company is producing a number of condenser tube alloys which are more resistant to this type of attack that rapidly perforates brass tubing. Outstanding in this respect is Duronze IV, an alloy which fortunately is now available for both land and marine power plants.

Although the merits of the Duronze IV type of alloy has been known for many years, only experimental quantities were produced because of the difficulties involved in its manufacture.

However, through special casting technique and the use of more powerful mill equipment, Bridgeport has solved this problem with the result that Duronze IV is now classed as one of our standard condenser tube alloys.

Proof of the superiority of the Duronze IV type of alloy to other condenser tube alloys for brackish water corrosion is well illustrated by the remarkable service record of an experimental installation of about 5000 tubes which were put into a seaboard condenser in 1913. These tubes had outlived their usefulness in 1942—*a period of 29 years*—in which time only minor replacements were made! In the same power plant, two adjacent condensers of identical design have been using Admiralty condenser tubes whose life averaged six years.

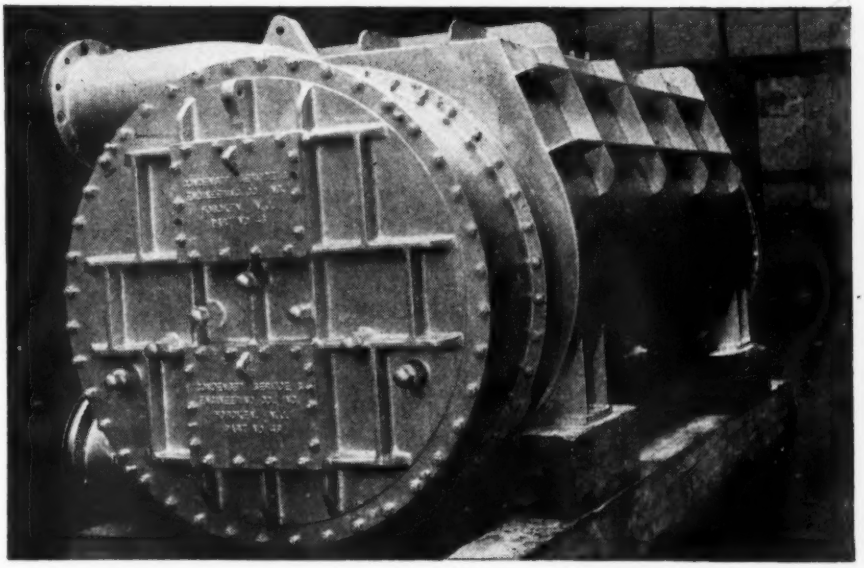
In another seaboard power plant where Admiralty lasts from 2½ to 3 years, and Aluminum Brass 4 to 5 years, Duronze IV has now been in about 5 years and is giving fine service.

An experimental lot of Duronze IV, Cupro Nickel, Aluminum Brass and Admiralty condenser tubes were installed in another seaboard power station which is troubled by brackish water resulting in excessive deposit attack. Here Admiralty and Aluminum Brass failed after 6 months, Cupro Nickel failed in about 1½ years while Duronze IV is still in fine condition after 3 years of service. Besides being excellent for general corrosion conditions, Duronze IV withstands impingement attack better than most other alloys.

Since Duronze IV does not "dezincify" it is also widely used in industrial applications such as for conveying hot, strong, brine solutions in salt refineries.

Engineers who are planning to retube their condensers would do well to consider using Duronze IV especially if operating conditions are too severe for ordinary condenser tubes. However, if they are not ready to do a retubing job, they should put in an experimental lot for periodic observation. Those who have not yet tried out Duronze IV have a pleasant surprise in store for themselves.

Much data on Duronze IV and other Bridgeport alloys and results of many years of corrosion research are published in Bridgeport's 80-page Condenser Tube Manual. Be sure to write for a copy using company stationery.



Photograph of condenser manufactured by the Condenser Service and Engineering Company.

Note: Bridgeport products are supplied in accordance with existing priority regulations.

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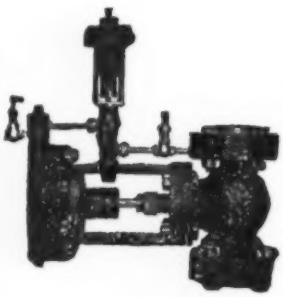

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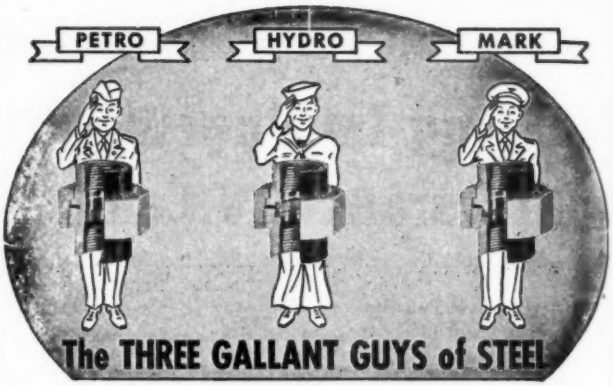

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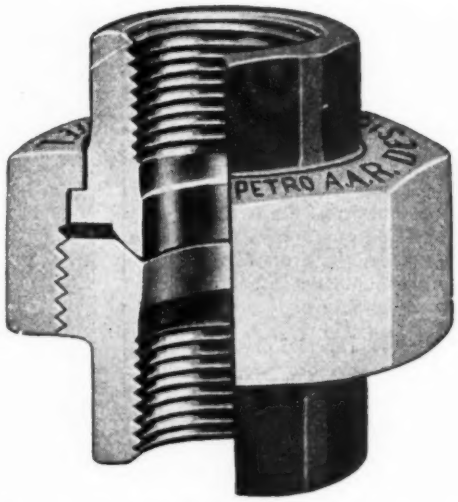

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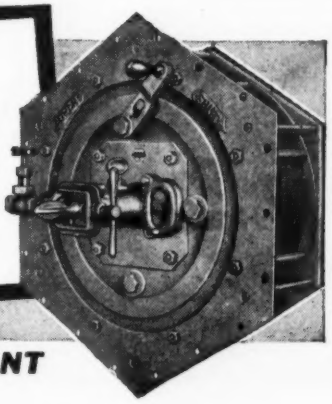
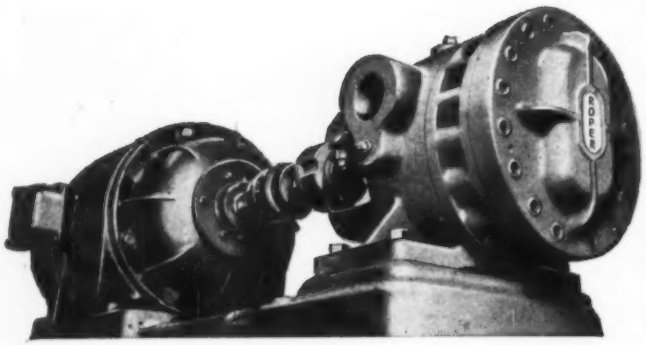


ON THE FIRING LINE OF AMERICA'S WAR PRODUCTION FRONT



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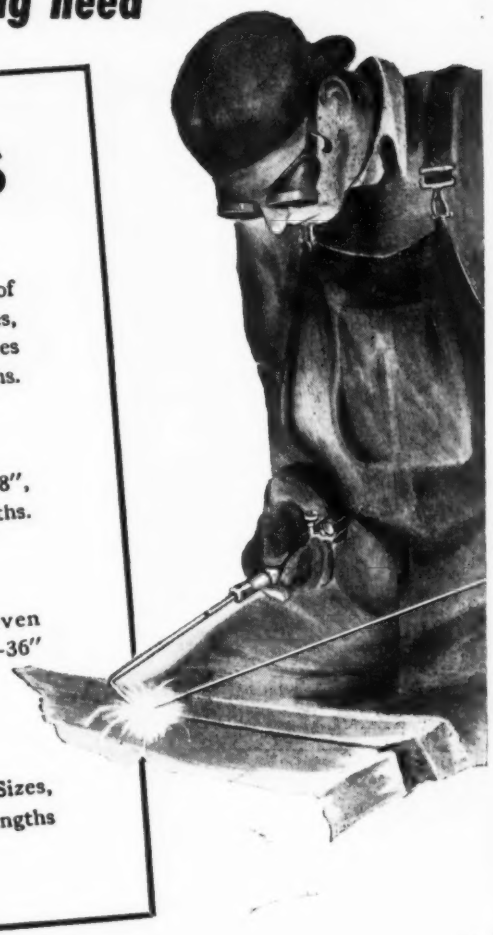

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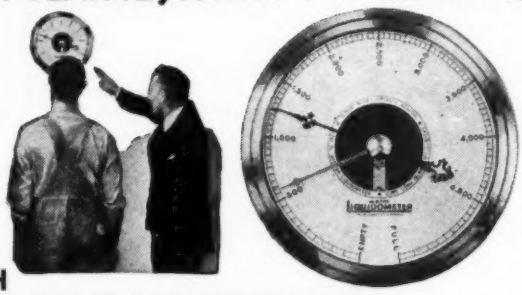

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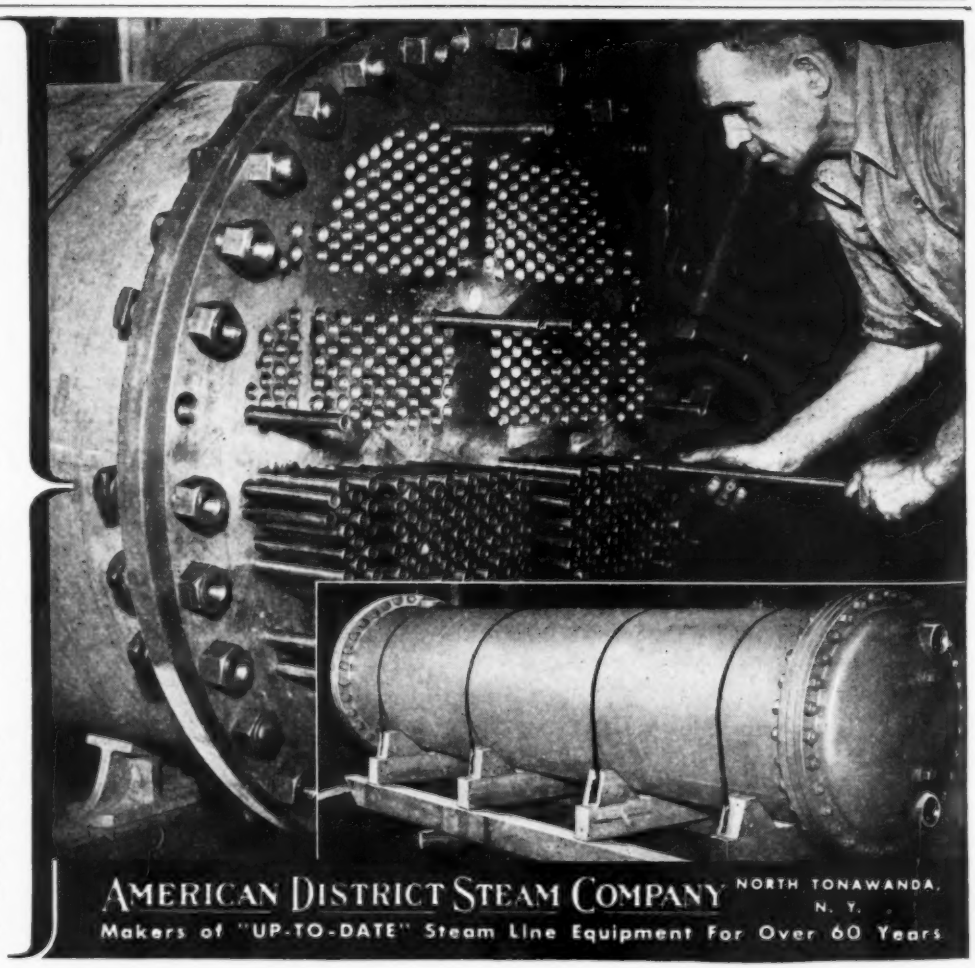

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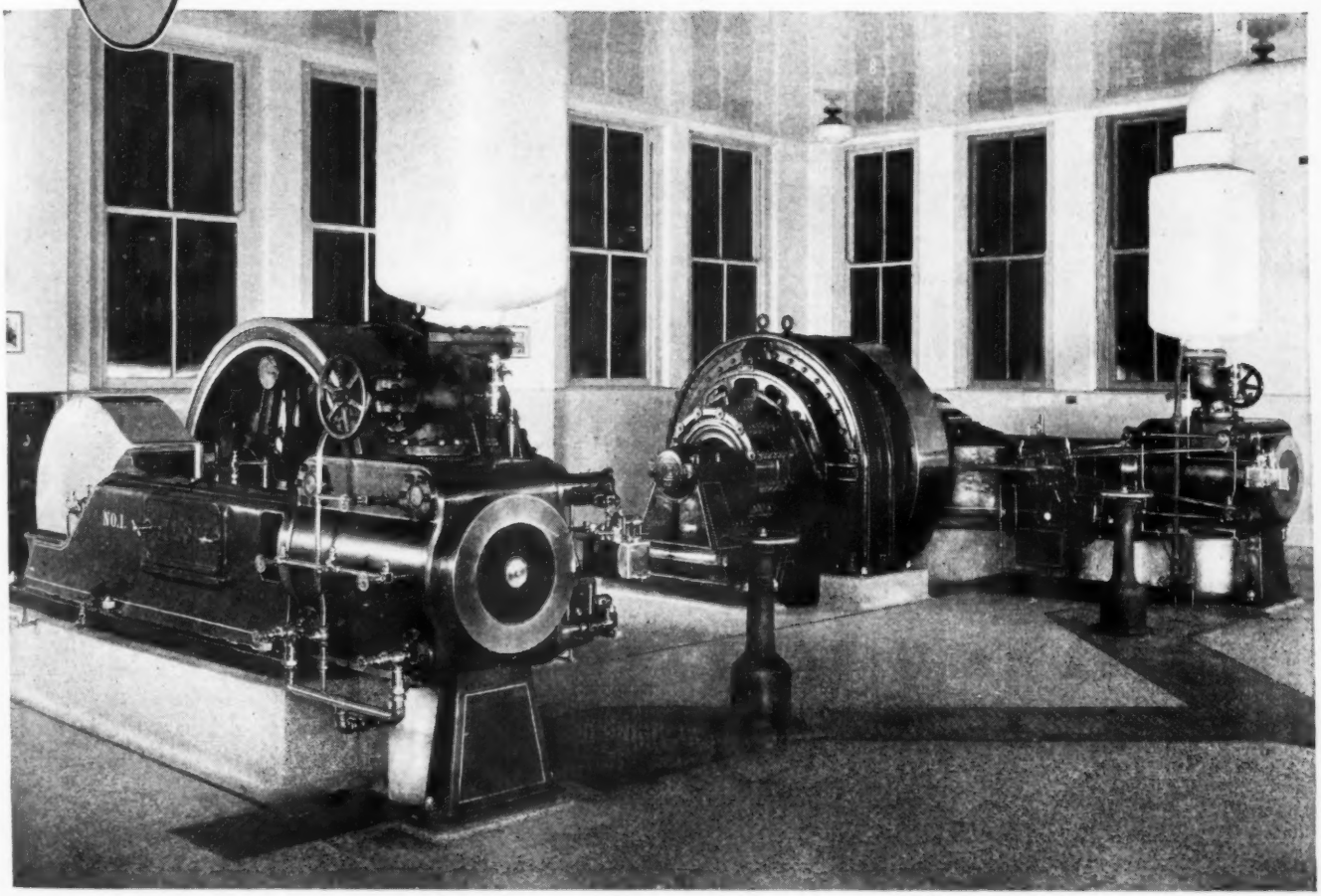

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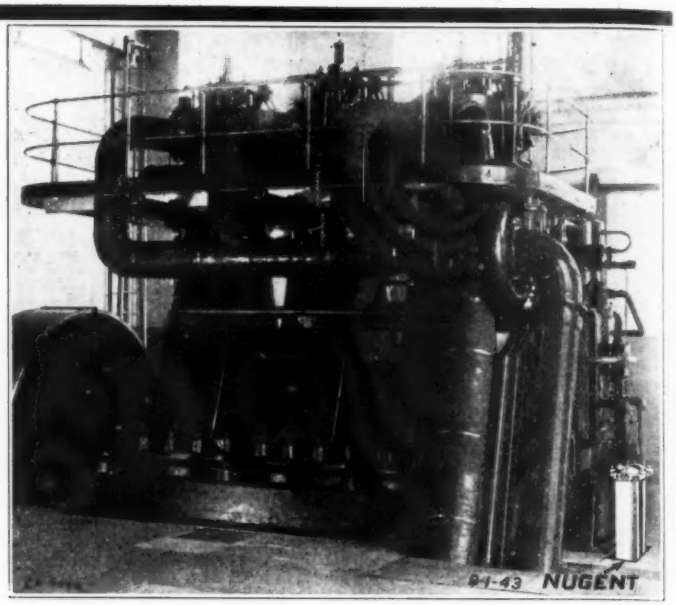

The photo above shows two Nugent Absorbent Type Lubricating Oil Filters installed on a Fulton Diesel engine at a pipe line station. About a year ago a supercharger was installed on this engine, increasing the HP from 520 to 890. The Nugent Filters were installed at that time. The engine was charged with three barrels of medium lubricating oil which has been in service since the supercharger was installed. Approximately one gallon of crackcase oil is added every 24 hours. Recent tests show only 0.010% very fine sediment in the oil . . . proof of the efficiency of Nugent Filters. Write for bulletins.

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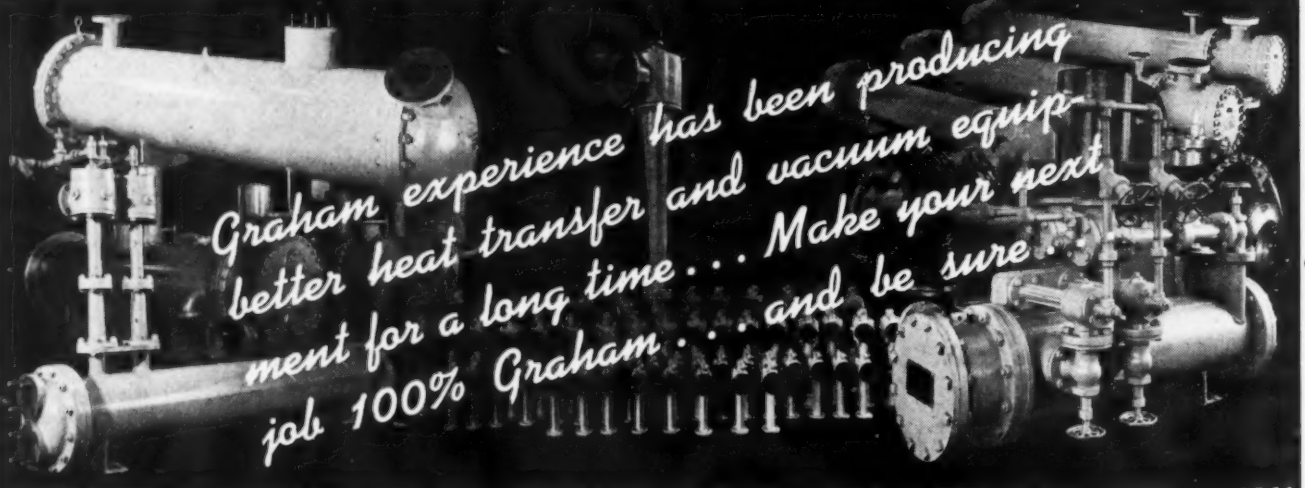

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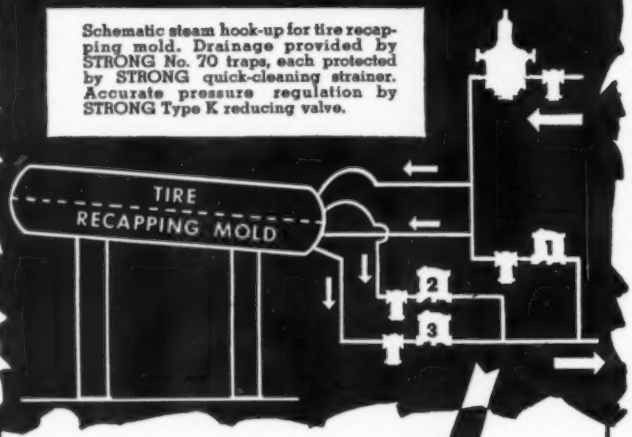
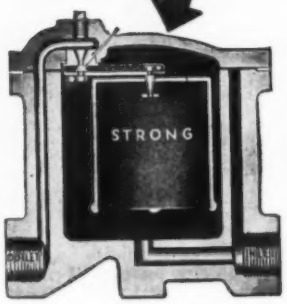
Schematic steam hook-up for tire recapping mold. Drainage provided by STRONG No. 70 traps, each protected by STRONG quick-cleaning strainer. Accurate pressure regulation by STRONG Type K reducing valve.



On Tire Recapping Units, complete condensate drainage is needed to assure the correct amount of heat at the mold. Three STRONG inverted bucket traps drain the (1) supply line (2) upper mold (3) lower mold.



STRONG 70 Series Trap Semi-Steel—for saturated steam to 150 p. s. i. working pressure.

The condensate rate is low, therefore, the patented STRONG anti-balancing device is valuable in preventing the "dribbling" which causes excessive wear. Strainers ahead of each trap prevent scale and dirt from interfering with operation.

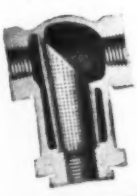
• • •

Completeness of the STRONG lines enables us to recommend exactly the type and size you need—open or inverted bucket, closed float, float-and-thermostatic (blast), etc.—forged, fabricated, (welded), cast and semi-steel construction. Send your problems to Strong, Carlisle & Hammond Company, Cleveland, Ohio.

OTHER STRONG STEAM SPECIALTIES

Reducing Valves

Strainers



Open Bucket Traps

P-343

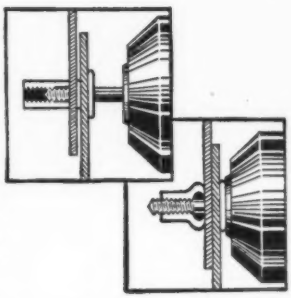
STRONG
STEAM SPECIALTIES

Ingenious New Technical Methods

Presented in the hope that they will prove interesting and useful to you.

New Air Tool Drives "blind" Rivets Accurately . . . Automatically

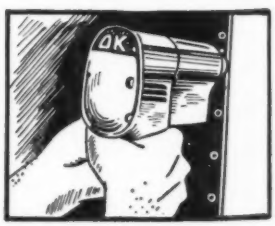
Installing "blind" RIVNUTS quickly with precise, positive upset while working entirely from one side is now possible with the recently developed Auto RIV-Driver. Completely automatic, the tool runs a threaded mandrel into a Rivnut, upsets it, backs the mandrel out and stops the tool. Operators simply press a throttle; make no manual adjustments for any operation. Rivnuts are installed 6 to 8 times faster than formerly; rejects are almost completely eliminated.



Rivnuts (mfd. by B. F. Goodrich Co.) are internally-threaded tubular rivets which can be installed "blind" while working entirely from one side of the job.

The tool can be adjusted to upset at any depth required. Once set, adjustment is tamper-proof —every Rivnut is driven accurately and uniformly. An indicator on the tool handle lights when the upset is correct; does not light if Rivnut is improperly headed.

Powered by compressed air, the Auto RIV-Driver weighs just 4¼ pounds; is 9½ inches long; balanced for efficient handling by women operators.



Automatic action, positive depth control and visual indicator assure correct and uniform installation of rivnuts with new Auto RIV-Driver.

You all know that our fighting men need the finest quality materials that we here at home can produce. That goes for Wrigley's Spearmint, Doublemint and "Juicy Fruit" chewing gum, too. Our stock pile of raw materials that goes into the making of Quality chewing gum is getting lower and lower. Until we can again build up our raw material inventory, we are sending all of our limited output of Quality chewing gum to our fighting men and women overseas, only.

You can get complete information from the Independent Pneumatic Tool Co., 600 W. Jackson Blvd., Chicago 6, Ill.

Y-118

MAKE ONE VALVE DO THE WORK OF 3 or 4

use HOMESTEAD 3-WAY OR 4-WAY VALVES

Because a *single* valve does the work of three or four shut-off valves, Homestead 3-Way or 4-Way Valves save operating time, trouble and expense, when used as fluid "flow changers" or "switching" valves. They are also ideal for use as operating valves to control single or double acting pistons which travel the full length of their stroke. Added savings result from the proved, lower-per-year maintenance cost and longer life typical of "Homesteads."

Homestead 3-Way or 4-Way Quarter-Turn Valves are made in sizes ½" to 12", in brass, acid-resisting bronze, semisteel, steel, Monel, Ni-Resist and other alloys for specific temperature, pressure and fluid conditions. For greater economy and convenience, specify Homestead 3-Way or 4-Way Quarter-Turn Valves on your next job. Consult Homestead engineers freely on all your valve problems. Write today for your copy of Valve Reference Book No. 93.

Maritime's two-flag, highest production award to our men and women making valves for the Victory Fleet.

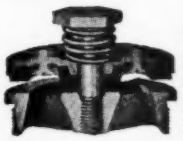
HOMESTEAD VALVE MFG. CO.

P. O. BOX 210 . . . . . CORAOPOLIS, PENNSYLVANIA

THE ORIGINAL
Tripp Metallic Packing
TRIPP METALLIC PACKING CO.
BOSTON MASS.

WHERE TO BUY
Featuring additional products and specialties for power plants

End Pump Troubles!
HILL IMPROVED PUMP VALVES

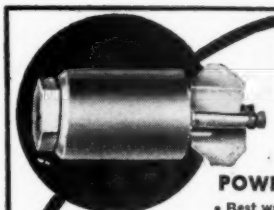


The valve with the renewable feature restores old pumps to original efficiency. Constant contact is maintained over the full bearing surface no matter in what position the valve rotates because of the exclusive HILL design. Efficient, durable, economical, accurate. Send today for bulletin that tells how to get better pump performance.

HILL PUMP VALVE CO.
2728 ELSTON AVE. CHICAGO, ILL.

CHIMNEYS
Industrial Waste Burners
AMERICAN CHIMNEY CORP.
141 Fourth Ave.
New York City
BRANCHES: BOSTON PHILADELPHIA · BUFFALO CLEVELAND · DETROIT

Specialists in
Anthracite Steam Coals
of the best quality
Let our Combustion Engineer help solve your fuel problem
FORESTON COAL CO.
INCORPORATED
500 Fifth Ave. New York, N. Y.
BOSTON • ALBANY • BUFFALO • OSWEGO
HARTFORD • SCRANTON • PHILADELPHIA



STEP UP POWER NOW WITH A MOHAWK POWER SCRAPER
Best way to remove soot, slag from boiler tubes. Baked slag quickly scraped and blown out by the Mohawk! Actually burnishes tubes—cannot possibly harm them. Uses steam or air. For all size fire tubes. Also inquire about Vibratrap Tube Cleaners for removing scale from fire and water tubes.
BRUNT EQUIPMENT CO.
60 S. DIVISION ST. BUFFALO, N. Y.

"MONO"
BOILER BAFFLES
HIGH TEMPERATURE
Refractory Cements
SANFORD C. SMITH REFRACTORIES, INC.
1715 NIAGARA ST., BUFFALO, N. Y.

Automatic Control
POWERS TEMPERATURE and HUMIDITY CONTROL
For Industrial Processes, Heating and Air Conditioning Systems, Hot Water Heaters and Shower Baths. Write for Bulletins.
Offices in 47 Cities
2771 Greenview Ave., Chicago, Ill.
THE POWERS REGULATOR CO.

PROFESSIONAL SERVICES

THE BIRD-ARCHER CO.
Engineers and Consultants on Water Conditioning Problems
Surveys . . . Plant Studies . . . Analyses
400 Madison Ave. New York, N. Y.

STANLEY ENGINEERING COMPANY
CONSULTING ENGINEERS
Power Plants
Steam - Diesel - Hydro
Design - Construction - Test - Valuation
Central State Bank Bldg., Muscatine, Ia.

H. E. CORL
CONSULTING ENGINEER
Design Supervision of Construction Management
Industrial and Municipal Power Plants
Steam and Diesel
Steam and Electric Power Distribution Systems
Plants Surveys Appraisals Reports
1316 Arch Street Philadelphia, Pa.

PUBLIC UTILITY ENGINEERING & SERVICE CORPORATION
CONSULTING ENGINEERS
Design Operations
Steam - Hydraulic - Gas
231 S. LaSalle St., Chicago (4), Ill.

JOHN A. STEVENS, Inc.
Established 1909
CONSULTING ENGINEERS
Power Plants Paper Mills
Dye Houses Surveys
Lowell, Massachusetts

GILBERT ASSOCIATES, INC.
ENGINEERS AND CONSULTANTS
Power Plant Design and Construction
Rehabilitation and Maintenance
Steam — Diesel — Hydro
Reports—Examinations—Laboratory
Industrials and Utilities
61 Broadway New York Reading, Pa. National Press Bldg. Washington, D. C.

SANDERSON & PORTER
Engineers and Constructors
for the
FINANCING—REORGANIZATION—
DESIGN—CONSTRUCTION—
of
INDUSTRIAL and PUBLIC UTILITIES
Chicago New York San Francisco

STONE & WEBSTER ENGINEERING CORPORATION
Design and Construction
Reports • Examinations • Appraisals
Consulting Engineering
BOSTON • NEW YORK • CHICAGO • HOUSTON
PITTSBURGH • SAN FRANCISCO • LOS ANGELES

HALL LABORATORIES, Inc.
R. E. HALL, Ph.D. Director
CONSULTANTS ON
BOILER WATER CONDITIONING
304 Ross St. Pittsburgh, Pa.

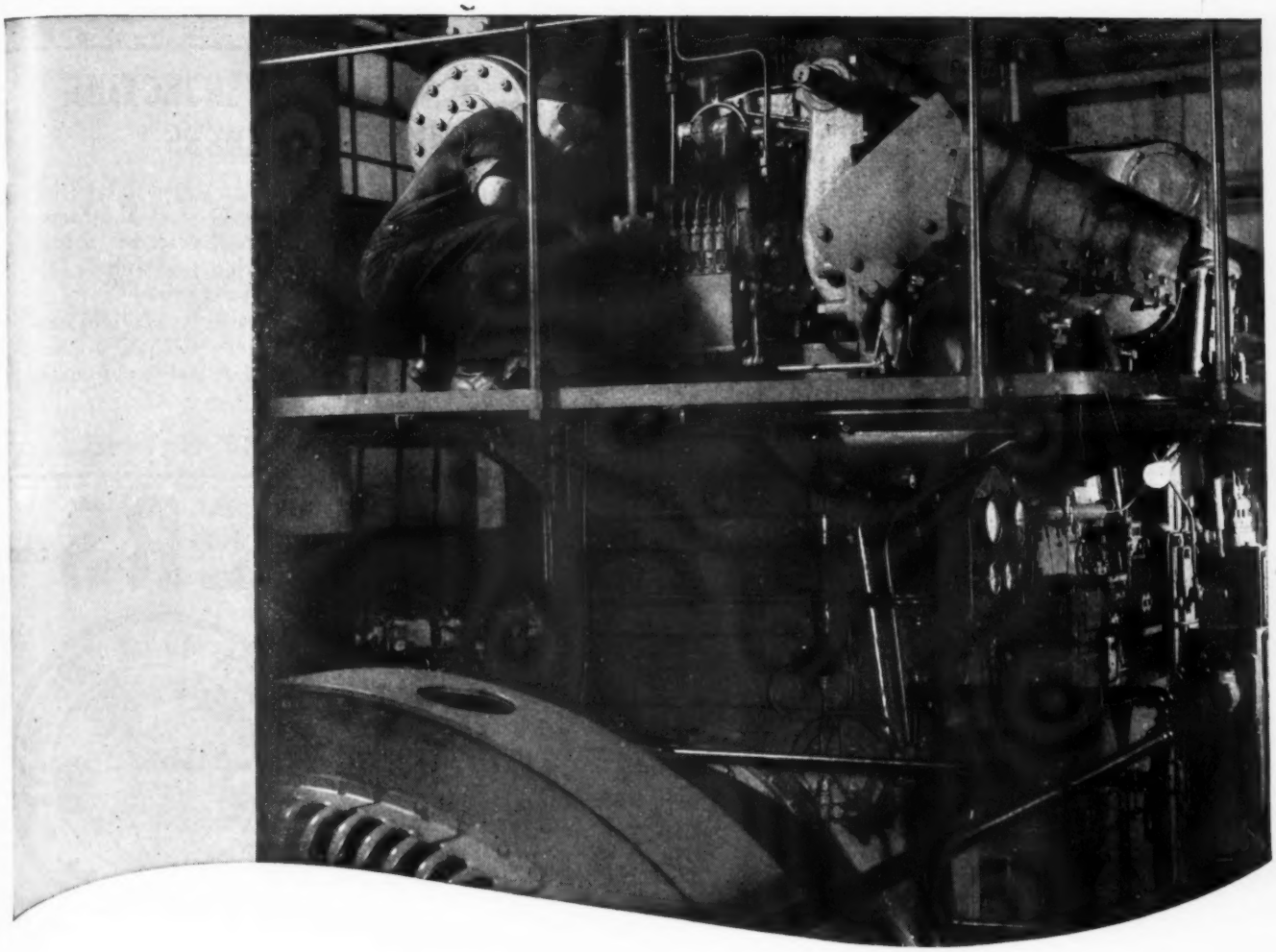
SARGENT & LUNDY
ENGINEERS
140 South Dearborn St.
CHICAGO, ILLINOIS

THE J. G. WHITE ENGINEERING CORPORATION
ENGINEERS—CONSTRUCTORS
New York, N. Y.

ZUCE KOGAN
CONSULTING SERVICE
NEW OR REHABILITATION OF
Steam Generating Plants
Power Steam & Diesel Plants
Combustion & Furnace Design
2967 S. LaSalle St., Chicago 16

J. E. SIRRINE & COMPANY
Power Plants Consultation
Design *Engineers* Reports
Water Steam Utilization Plans
Greenville South Carolina

WHITMAN, REQUARDT AND ASSOCIATES
Engineers — Consultants
Power Plants — Industrial Plants
Steam and Electric Distribution Systems
Waterworks and Sewerage
Reports—Plans—Supervision—Appraisals
1304 St. Paul Street Baltimore 2, Md.



Diesel operating records reflect better lubrication with Gulf Parvis Oil—

TO help keep your Diesels delivering maximum kw.-hrs. at minimum cost for maintenance, take a tip from scores of power plants that report definitely improved lubrication with Gulf Parvis Oil.

Gulf Parvis Oil provides an extra margin of protection for hard-to-replace parts — helps prevent excessive wear that leads to shutdowns and below-par performance. Maintenance economies and greater operating efficiency are bound to accompany the proper application of a lubricant with the research background and proven service performance record of this quality Diesel lubricating oil.

If you are not one of the many enthusiastic users of Gulf Parvis Oil, it will pay you to investigate—call in a Gulf Lubrication Service Engineer today and ask him to recommend the proper type and grade to fit your particular requirements. Write or phone your nearest Gulf office.

GULF INDUSTRIAL LUBRICATION

GULF OIL CORPORATION
GULF REFINING COMPANY
GULF BUILDING, PITTSBURGH 30, PA.

—Back the Attack
Buy More War Bonds!

INSURE UNIFORM BOILER WATER BY INJECTING COMPOUND WITH MANZEL FEEDERS

You can avoid the troubles resulting from hit and miss methods of boiler water treatment by injecting your boiler compound with a Manzel Chemical Feeder. The Manzel Feeder is installed directly on the feed water pump and injects the correct amount of chemical in exact proportion to the amount of water entering the boiler. Thus, every gallon of water entering the boiler is treated, and treated correctly.

The driving mechanism of Manzel Chemical Feeders is enclosed in an oil-tight case. Only the pumping unit comes in contact with the chemical. Feed is easily adjusted and once set, the Feeder requires no attention except to keep chemical tank supplied.

Write for Bulletin

MANZEL BROTHERS COMPANY 326 Babcock St., Buffalo 10, N. Y.

BROWNELL BOILERS

For 88 years this company has been making good boilers. We invite comparison on quality, price, and delivery of various types and sizes of fire tube boilers from 3 H. P. to 250 H. P.

Write us for illustrated bulletins.

THE BROWNELL COMPANY the World Over SINCE 1858 DAYTON, OHIO, U.S.A.

From Here To There With Minimum Loss —A NAVY IDEA—AND OURS!

The Navy transport idea of getting our full power to the battle zones with a minimum of loss is also the watchword of the Heat Exchanger industry. The very purpose of heat exchangers is to make a transfer with minimum loss, minimum waste, maximum efficiency.

BALLOU HEAT EXCHANGERS

are designed to your requirements with this aim always in mind. Strict adherence to specifications, accurate engineering, precise manufacturing, complete follow-through service—these are the features to look for, the features that make BALLOU Exchangers a standard of quality.

Check your needs - and when you want Condensers - Evaporators - Distillers - Air Coolers - Oil or Water Heaters - Clarifiers - Extractors - Separators - Strainers - or

SERVICE

Phone, wire or write Ballou

Ballou SERVICE & INSTRUMENT CO., INC.

75 WEST ST., NEW YORK, N.Y.
TEL. BOWLING GREEN 9-6855-6

A COMPLETE SERVICE ORGANIZATION FOR REPAIRING REBUILDING AND CLEANING HEAT EXCHANGERS OF ALL TYPES

SEARCHLIGHT SECTION

EMPLOYMENT • BUSINESS • OPPORTUNITIES • EQUIPMENT—USED or RESALE

UNDISPLAYED RATE:

10 cents a word, minimum charge $2.00.

(See ¶ on Box Numbers.)

POSITIONS WANTED (full or part-time individual salaried employment only), ½ the above rates.

PROPOSALS, 50 cents a line an insertion.

INFORMATION:

BOX NUMBERS in care of any of our New York, Chicago or San Francisco offices count 10 words additional in undisplayed ads.

DISCOUNT of 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

DISPLAYED—RATE PER INCH:

The advertising rate is $6.30 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

AN ADVERTISING INCH is measured ⅞ inch vertically on one column, 3 columns—30 inches —to a page. P.

NEW ADVERTISEMENTS received by June 7th will appear in the July issue, subject to limitations of space available.

To EMPLOYERS WHO ADVERTISE FOR MEN:

THE letters you receive in answer to your advertisements are submitted by the applicants with the hope of securing the position offered.

Frequently when there are many applicants, the only letters acknowledged are those of the most promising candidates. Others may not even receive the slightest indication that their letters have been received, much less considered. These men often become discouraged, will not respond to future advertisements and sometimes even question their bona fide character.

Every advertisement printed in the searchlight section is duly authorized. It will help to keep readers interested in this advertising if you will make it a practice to acknowledge every application received, even if you merely return the letters of unsuccessful applicants marked, "Position filled, thank you." If you don't care to reveal your identity, you might mail them in plain envelopes.

This suggestion is made in a spirit of friendly cooperation between employers and the men replying to Positions Vacant advertisements.

Departmental Staff,

McGRAW-HILL PUBLISHING CO., Inc.

★

"Put yourself in his place"

POSITIONS VACANT

DESIGN ENGINEER WANTED, experienced centrifugal and turbine pumps, capable modern theory and design. Midwest location. Give experience, education, etc. Address P-657, Power, 520 N. Michigan Ave., Chicago 11, Ill.

YOUNG ENGINEER with knowledge of Steam Boiler Plants and chemical background to handle engineering details, proposal writing and general office management. Location Philadelphia. Position can lead to outside sales work. In reply give full personal information. Draft status, photograph, previous employment record and salary expected. P-690, Power, 330 W. 42nd St., New York 18, N. Y.

WANTED: Assistant to busy executive in Engineering Department of large food plant. Able to assume responsibility and all details. Excellent opportunity. Steady post-war position. State age, experience, salary, etc. P-702, Power, 330 W. 42nd St., New York 18, N. Y.

WANTED by major Oil Refinery in Southwest first class electricians well versed in both A.C. & D.C. theory. At least 7 years experience in maintenance of Oil Circuit Breakers, Relays, Meters, Transformers, Motors and Controls and Trouble Shooting. Education—high school or better. Release necessary from defense job. P-703, Power, 520 N. Michigan Ave., Chicago 11, Ill.

WANTED EXPERIENCED men; one as assistant superintendent, one as first class mechanic, both positions open at the Central Heating Plant. U. S. war veterans considered. State age, qualifications, acceptable salary, and class of honorable discharge in first letter to: University of Idaho, Central Heating Plant, Moscow, Idaho.

AN OPPORTUNITY to make a highly profitable connection with a well established chemical corporation specializing in proven water treatments, soot removers, slug eliminators and related essential products. Excellent protective territories available. Write in confidence. P-705, Power, 330 W. 42nd St., New York 18, N. Y

(Continued on page 360)

PUMPS

An Audel Guide! 3 Books in One!

Now Ready—

AUDELS PUMPS
HYDRAULICS
AIR COMPRESSORS

A New Modern Comprehensive Guide for Engineers, Pump Operators and Mechanics.

1650 Pgs., 1654 Illustrations

Size 5 x 6¾ x 1¾—Fully Indexed For Ready Reference including

QUESTIONS AND ANSWERS

This Book Covers a Long Felt Need for One Inclusive Volume dealing with the whole field of modern Pumps, Hydraulics, Air Compressors and the many lines that tie in. Easy to understand.

To get this assistance for yourself, simply fill in and mail *FREE COUPON* today.

$4 COMPLETE

PAY ONLY $1 A MO.

AUDEL, Publishers, 49 W. 23 St., New York 10

MAIL AUDELS PUMPS, HYDRAULICS, AIR COMPRESSORS (Price $4) on 7 days free trial. If O.K., I will remit $1 in 7 days and $1 monthly until the $4 is paid. Otherwise I will return it.

Name_____

Address_____

Occupation_____ PWR

WANTED

STEAM POWER PLANT ENGINEER

Capable of selecting all equipment and supervising preparation of mechanical drawings and specifications for industrial power plants. Prefer man under 45. Position is with established firm and offers permanency and advancement to qualified applicant. Answer by letter giving full details.

P-700, Power
330 West 42nd St., New York 18, N. Y.

POSITION VACANT

By long established contracting concern for man familiar with boiler erection, refractory work and fire brick repair work, with experience in contact and estimating. Please state experience, age, draft status and salary expected. This position is permanent with opportunity for advancement for right man.

P-685, Power
330 W. 42nd St., New York 18, N. Y.

Chief Engineer Wanted

A once-in-a-lifetime opportunity for a top-flight chief engineer qualified to direct busy post-war activities on precision mechanical, hydraulic and electrical control equipment. Long established "E" award Eastern manufacturer, located near Metropolitan area in attractive residential community. Please give detailed experience, age and draft status and salary requirements.

P-687, Power
330 W. 42nd St., New York 18, N. Y.

HELP WANTED—MALE

DESIGNING ENGINEER

for permanent position with old established company. Experience in design or sales of mechanical and hydraulic equipment desirable but not necessary. State fully, experience, education etc. Replies will be held confidential.

P-701, Power
330 West 42nd St., New York 18, N. Y.

WANTED

ENGINEER

For large food manufacturing company. Good general knowledge sugar industry and food processing work required. Excellent opportunity. Steady, post-war position. State age, experience, draft status, salary, etc.

P-696, Power
330 W. 42nd St., New York 18, N. Y.

ADDITIONAL EMPLOYMENT ADVERTISING ON PAGE 360

SEARCHLIGHT SECTION

EMPLOYMENT SERVICE
(Continued from page 359)

SALARIED POSITIONS — This advertising service of 34 years recognized standing negotiates for high salaried supervisory technical and executive positions. Procedure will be individualized to year personal requirements and will not conflict with Manpower Commission. Retaining fee protected by refund provision. Identity covered and present position protected. Send for details. R. W. Bixby, Inc., 270 Delward Bldg., Buffalo, N. Y.

POSITIONS WANTED

ELECTRICAL ENGINEER with 14 years experience in the fields of construction and operation of diesel and hydro electric power plants, transmission systems, mining, milling and industrial installations. Married with small family. 40 years of age, Class 3A(H), excellent health and no physical handicaps. At present am managing-supt. of a municipal power plant and distribution system in a town of about 1500. Reason for desired change is to be located where more sunshine and better schools are to be enjoyed, also, that present position holds no further future for advancement. Definitely not a boomer or drinker, excellent references. Availability on 30 days notice. Write PW-673, Power, 68 Post St., San Francisco 4, Cal.

POWER ENGINEER: At present operating head of a large power system, and responsible for an annual saving of over $1,000,000 by improved operation, is available for new engagement either with an operating or engineering organization. New York City preferred. PW-706, Power, 330 W. 42nd St., New York 18, N. Y.

SALESMAN WANTED

SALES ENGINEER with Steam Power Plant and general chemical background for well-established Eastern territory. Send full personal information, snapshot. Draft status, prior connections and advise salary wanted in reply. SW-691, Power, 330 W. 42nd St., New York 18, N. Y.

FOR SALE

FOR SALE—one Westinghouse Stoker, grate size 108" wide by 6'1½" long. One 72" wide and a 7'1½" long, complete except one #1 ¾ fan and a 7½ H.P. 110V AC motor. Complete list of repair parts for above stokers. FS-707, Power, 330 W. 42nd St., New York 18, N. Y.

FREE BULLETIN

CLASSIFIED STOCK SUMMARY—April issue —5½x8½—36 pages—classified and indexed. Covering electric generating and transmission equipment, and construction equipment released for sale by the 22 gas and electric utility company clients. Write Ebasco Services, Inc., 2 Rector St., New York 6, N. Y.

WANTED

ANYTHING within reason that is wanted in the industry served by Power can be quickly located through bringing it to the attention of thousands of men whose interest is assured because this is the business paper they read.

WANTED

SALES REPRESENTATIVES

In key industrial areas sales representatives with active, successful organizations calling on metal, chemical, power, process and kindred industries. Product: full line of well-established, widely used air, gas and liquid control valves. Experience with valves, control equipment, pumps or similar industrial products desirable. Very attractive commission rate and full sales and engineering cooperation.

RW-698, Power
330 West 42nd St., New York 18, N. Y.

REPRESENTATIVES AVAILABLE

ADDITIONAL LINES WANTED

For New York City and Texas Gulf Coast Area by firm with sales force contacting Oil, Chemical and Power Engineers and Purchasing Agents.

Interested in any machinery or materials used by these industries.

Reply to Houston Pipe & Steel Company, Room 2606, 420 Lexington Avenue, New York 17, New York.

FOR SALE

OPERATING DIESEL — ELECTRIC PLANTS

1—360 H.P., FBM, 6 cyl. full diesel style VA gen. 300 Kva, 2300 v., 3ph., 60, dir. conn. ex.
Complete with aux. and panel.

2—Units each
200 H.P., FBM, 4 cyl. Style V, semi-diesel gen. 170 Kva, 2300, 3ph. 60, dir. conn. ex.
Complete with aux. and panel.

OTHER APPARATUS INCLUDING

1—Syn. motor, West., 1440 H.P., 2300/400 v., 3 ph. 60, 514 r.p.m., dir. conn. ex.

1—West., 2200 volt, 800 H.P., reversing contactor

4—G.E., HITC, 75 H.P., 600, 550 V., sl. ring motors

4—G.E., HITC, 200 H.P., 600, 550 V., sl. ring motors

4—G.E., HITC, 300 H.P., 600, 550 V., sl. ring motors

4—G.E., sl. ring 50 H.P., 600, 440 V.

4—G.E., sl. ring 150 H.P., 600, 440 V.

4—G.E., sl. ring 200 H.P., 600, 440 V.

Magnetic and manual control for above motors,

1—500 Kva, mixed pressure turbo-generator

A. E. SMITH & L. O. B. LINDSTROM
145 Erie Street
San Francisco 3, California
Hemlock 7313

FOR SALE

1—750 K. W. Allis-Chalmers Turbo Generator, 80% power factor, 3 phase, 60 cycle, 480 volts at 3600 RPM with a direct connected 126 volt exciter with jet condenser-switch board and other auxiliaries.
1—625 K. W. Allis-Chalmers Turbo Generator, 80% power factor, 3 phase, 60 cycle, 480 volts at 3600 RPM complete with direct connected exciter, 126 volts with jet condenser-switch board and other auxiliaries.
1—Laidlaw Dunn Gordon cross compound air tandem steam air compresser with inter-cooler, size 11" x 20"/12" x 18"—750 CFM.
2—15" x 10" Allis-Chalmers steam driven vacuum pump, steam end—6' x 10".

Muncie Builders Supply Co.
800 South Council St. Muncie, Ind.
Telephone 3368

Westinghouse Heater Controllers
Style 447196
2—Complete units mounted in 28 x 28 x 34 inch steel cabinets. Capacity 146 K.W. at 440 volts, 3 ph. Can also be used on 220 or 550 volt. Price each $175.00.
BUTLER ELECTRIC CO.
1885 Milwaukee Chicago, 47, Ill.

FOR SALE

SURPLUS EQUIPMENT

AIR COMPRESSOR
Chicago Pneumatic, Serial #13387-NSS, 8-8x8, tandem steam driven, single cylinder with Mantzel lubricator. Is in good condition and gave excellent service when in operation.

AIR MOTOR
Ingersoll-Rand, stationary type, serial #A24653, size EEM.

EXCITER
Allis-Chalmers, #106248, turbine driven, V.N.L. 125, full load 125, 120 amp., 3600 RPM, compound wound, complete except turbine does not have a governor throttle valve. Has not been operated recently.

INDUCTION MOTOR AND PUMP
(Motor) Allis-Chalmers, #2K19327.1, 125 HP, 1750 RPM full load, 2200 volt, 2 phase, 60 cycle, 25 amp., 40°C. full load, 55°C. 25% overload.
(Pump) Allis-Chalmers, #10930, size 6, type HS, 1390 GPM, 233 ft. head, 1760 RPM.

OIL CIRCUIT BREAKERS
Several 4-pole, 200-400 amp., 4500 volt mounted remote on pipe frame work with disconnect switches.

SWITCHBOARD FEEDER PANELS
Several Westinghouse 90", black marine with meters.

TRANSFORMERS
2—500 KVA General Electric 6600-2300 Volt, type A, form L, 60 cycle, Serial Nos. 1255200 and 1255201.
2—500 KVA General Electric 6900/11950, 60 cycle, 230-460 volt sec., Serial Nos. 1828006 and 1828007, Type H, Form KDD, with 2½-5-7½-10 per cent taps.
2—Kuhlman, furnace type, 6600 volt, 90 L.V., 150 KVA, serial Nos. 921267 and 921346.
1—Kuhlman, furnace type, 6600 volt, 100 L.V., 125 KVA Serial No. 915511.

VERTICAL STEAM ENGINE AND FAN
(Engine) Clarage, vertical type, serial #1316, size 6" x 6" with flyball governor driven off a flywheel.
(Fan) Clarage No. 70.

Board of Public Works
Grand Haven, Michigan

WANTED

ATTENTION OPERATORS OF B & W BOILERS

#24 Class E

We have a set of new tubes for one of these 303 HP Stirling boilers, for immediate delivery.

HETZ CONSTRUCTION CO.
Warren, Ohio

For Sale at a good price

Approximately 852 feet of Brand New 10" Asbestos V-Dent pipe insulation, 3" thick, with regulation canvas jacket and bands, in original cartons. This pipe covering manufactured by the Norristown Magnesia and Asbestos Company.

Phil-Fibre Box Board Mills, Inc.
Delaware Avenue & Tasker Street
Philadelphia, Pa.

THE ALIEN PROPERTY CUSTODIAN

offers at public sale with sealed bids the following described property (all new—in original packing cases) formerly owned by foreign nationals

Mitsubishi Shoji Kaisha, Ltd., V.O. #133—8/28/42
Societe Anonyme des Usines Renault, V.O. #594—12/30/42

LOT NO. 1

1—20 panel Westinghouse Metalclad switchboard in groups as follows:
A. 5 panels for 600 ampere—110 Volt single phase. 2 wire 50 cycle Feeders using DA-50 Air circuit breakers 2 pole with 600/5 current transformers. Each Feeder has ammeter.
1 panel for 2 incoming lines 110 Volt, 3 phase. 50 cycles including DA-100 air circuit breaker 4000 amps, ammeters and voltmeter.
B. 6 panels for control of 800 ampere 220 Volt 3 phase 50 cycle feeders, each feeder with ammeter, DA-50 air circuit breaker and 2—1000/5 current transformers.
1 panel for control of 2—1000 KVA 220 Volt 3 phase 50 cycle incoming lines including ammeter and voltmeter and 3000 ampere DA-75 air circuit breaker.
C. 4 panels for control of 2—800 Ampere 250 Volt DC feeders having 6-DA-50 air circuit breakers 2 P. and ammeter.
1 panel same as above 4 panels except having only one circuit.
2 panels for control of generator of a 600 KW MG set having 3000 ampere DA-75 air circuit breaker 2 pole, voltmeter, ammeter, equalizer switch and Reverse current relay.
Copper and Micarta Barriers for each group.

LOT NO. 2

1—120 cell Philco 9KO (X) Dry Seal Battery consisting of 2—120-V-9 KO (X) 21 dry seal batteries complete with racks, set of numerals #1 to 120 incl., 2 spare jars G-503), 2 spare covers H-820-R, 10 spare separators E-474 and 7 carboys of electrolyte 1.400 Sp.gr.
1—Battery charging MG set consisting of:
1—¾ KW Westinghouse frame 204-SK generator, 2 wire, 250 volts D.C., 40° C. Cont., 1450 RPM shunt wound 2 bearing.
1—1½ H.P. Westinghouse frame 224-CS, 220 Volt, 3 phase, 50 cycle, 1450 RPM, 2 bearing induction motor.
1—Base, couplings and mechanical parts on which is assembled the above Motor and Generator to make a complete motor-generator set.
1—Battery Charging Panel for control of above MG set.

LOT NO. 3

1—Westinghouse Type GO-2A Oil circuit breaker (less the oil) rated 600 amperes 69 KV, 3 PST, electrically operated, automatic, with bushing current transformers, 250 Volt D.C. close and shunt trip coils, 3-CO relays, and 1-OCB control switch. Interrupting capacity 1,000,000 KVA at rated voltage.

LOT NO. 4

1—12 cubicle Metalclad Switchgear with verticle lift breakers, part of a 13 cubicle switchgear on which cubicle #9 and breaker #9 are missing. These are in 3 groups as follows:
Group A—5 cubicles
#1 —For control of a feeder and includes a 600 ampere 15 KV B-22-B Westinghouse oil circuit breaker, electrically operated, automatic, with ammeter, watt hour meter, and overcurrent relay.
#2)—For control of a feeder and each containing a 600 ampere 15KV Westinghouse B-
#3) 22-B oil circuit breaker, electrically operated and automatic, and ammeter, an
#4) overcurrent relay, control switch, current
#5) transformers, watthour meter and Type CA transformer differential relay.
Group B—4 cubicles out of 5 in original set. numbered 6 to 10.
#6 —Incoming Line cubicle for 10,000 KVA, 3300 Volts 3 phase, 50 cycles and includes a 600 Ampere 15 KV Westinghouse B-22-B oil circuit breaker, current transformers, 3300/110 potential transformers, 3000 ampere disconnect switch, ammeter, voltmeter, watthour meter and surge protective equipment.
#7)—For control of motor of a 600 KW, 3300
#8) volt, 3 phase, 50 cycle MG set, for full voltage starting. Includes a 600 ampere 15 KV Westinghouse oil circuit breaker, electrically operated and automatic, current transformers ammeter, power factor meter, D.C. field ammeter, watthour meter, CO relay, thermal relay, pull out relay and field ACC. panel.
#9 —This cubicle missing.
#10 —For control of a feeder and includes a 600 ampere 15 KW Westinghouse oil circuit breaker electrically operated, automatic, with ammeter, watthour meter, and overcurrent relay.
Group C—3 cubicles.
#A)—Each for control of a 600 H.P. 3330 Volt,
#B) 3 phase 50 cycle induction motor, full
#C) voltage starting. Each includes a Westinghouse B-22-B 600 Ampere 15 KV oil circuit breaker, electrically operated, automatic, with current transformers, ammeter, thermal relay, overcurrent CO relay, CV voltage relay, and breaker control switch.
1 —Spare Westinghouse B-22-B 15KV, 600 ampere oil circuit breaker.
1 —Compartment to Bolt against unit #A above.

LOT NO. 5

Miscellaneous Items for Use With 13 Cubicle Switchgear
250 lbs. of Compound #1001.
24—Compound boxes (½x6") (½x3" top tap)
3—Compound boxes (½x8") (½x6" top tap)
9—Compound boxes (½x3") (½x3" top tap)
20 Pieces of copper bus ½"x6"x27¾" long
2—Pieces of copper bus ½"x6"x31¾" long
6—Pieces of copper bus ½"x3"x27¾" long
8—Pieces of ground bus ¼"x2"x27¾" long
3—Pieces of ground bus ¼"x2" (Formed in odd shape)
7—Sets of bus supports for 6" bus
3—Sets of bus supports for 3" bus
2—Pieces copper bus ½"x6"x36½" long
1—Piece copper bus ½"x6"x6"
1—Piece copper bus ½"x6"x12"
1—Piece copper bus ½"x6"x12"
1—Piece copper bus ½"x3"x14¾"
1—Piece copper bus ½"x3"x20¼"
1—Piece copper bus ½"x3"x25¼"
4—Yale locks and keys
3—Switches
23—Sets of terminal block hardware
1—Switch key S #1151536
2—Test plugs Style #694700
3—Complete sets of bus supports for 3" bus
1—Operating handle for disconnect switch.
50—Rolls 1" empire tape Westinghouse #1266
30—Rolls 2" empire tape Westinghouse #1266
2—Rolls 6" empire tape Westinghouse #1266
25—Rolls 1" cotton tape Westinghouse #7560
1—Quart clear varnish Westinghouse #3395
1—Quart black varnish Westinghouse #1736
1—Quart shellac Westinghouse #1133

LOT NO. 6

Miscellaneous
3—Westinghouse Type SV autovalve Lightning Arresters for 69 KV ungrounded Neutral Service. Westinghouse Style #1151613.
6—Bus supports 69 KV for ¾" I.P.S. tubing. Westinghouse Style #949073.
4—Bus supports 69 KV for 1½" I.P.S. tubing. Westinghouse Style #949076.
3—Bus supports 69 KV for 2/0 wire. Westinghouse Style #949071.
3—Bus supports 69 KV for ¾" I.P.S. tubing. Westinghouse Style #949098.
20—Bus Supports 7.5 KV for two—4"x¼" edgewise bars on Fin. Westinghouse Style #694885.
2—Pieces of hard copper bar .375" diam. and each 10' long.
15—Pieces of hard copper bar, each 14' long x .250"x4".
30—Feet of .365" diam. bare copper wire.
20—Feet of #2 flexible copper cable 61 of .0285 bar.
6—Terminals for 1000 MCM cable — Westinghouse Style 1123976.
12—Terminals for ¾" I.P.S. Westinghouse Style 1123984.
65—½—13x1½ hex. C. Alloy Bolts #4901.
65—½—13 Hex. C. Alloy Nuts #4901.
65—Lock Washers—Westinghouse Style #570068.
400—Feet of 2/0 bare copper cable 6 of .138 diam.
2—Bus supports 69 KV for ¾" I.P.S. Westinghouse Style #949073.
1—Westinghouse type KA Air Break disconnecting switch 69 KV 600 amperes, 3 P.S.T., with horns and single offset mechanism.
12—Expansion Bends.
46—Feet of 1½" I.P.S. Hard Drawn Copper Tubing; 1 piece 6 feet long, 2 pieces each 20 feet long.
200—Feet of ¾" I.P.S. Hard drawn copper tubing; 10 lengths of 20' each.
3—Live Line Clamps—Railway & Industrial Engineering Co. #19734.
9—Westinghouse Style #570942 Eye Hooks.
3—Westinghouse Style BT—5010 Strain Clamps.
6—Westinghouse Style BT—5015 Strain Clamps.
21—Westinghouse Style #570265 Porcelain Strain Insulators.
10—Copperweld Ground Rods ⅝" diam. x 8' long.
2—Couplings for 1½" I.P.S.—Penn Union Catalogue #2006
3—Couplings for ¾" I.P.S.—Penn Union Catalogue #2003
5—Tee Connectors ¾" x ¾", Penn Union Catalogue #1509
3—Tee Connectors 1½" x ¾"—Penn Union Catalogue #1524
11—Cross Connectors for 2/0 wire—Penn Union #GXA—2
3—Parallel Clamps for 2/0 wire—Penn Union #UC—3
10—Rod Clamps ⅝" Rods for 2/0 wire—Penn Union #GT—5
13—Single Cable Column Clamps—Penn Union #GM—2 except with boss for 11/16" Mounting holes.
7—Double Cable Column Clamps. Penn Union #GH—2 except with boss for 11/16" mounting holes
3—Straight couplers for .375" diam. wire—Penn Union Catalogue #2200.
2—Motor Operated Field Rheostats, for 875 H.P. 80 percent P.F. 3 phase 50 cycle, 3300 Volts. 750 RPM, Synchronous motors. Rheostat motor voltage is 250 volts DC.

LOT NO. 7

4—G.E. Motors 30/15 HP, 200 volts, 3 phase, 50 cycle, Model 5KG-504CK
2—G.E. Motors ¼HP, 440 volt, 3 phase, Model 5K-43 AC 43 and 465B
2—G.E. Motors 1½ HP, 220/440 volt, 3 phase, 60 cycle, 1725 RPM
2—G.E. Motors ½ HP, 220/440 volt, 3 phase, 50 cycle, Model 110238, 1425 RPM
1—G.E. Motor 2 HP, 220 volt, 3 phase, 50 cycle, Model 5KG254, 750 RPM
2—G.E. Motors 5 HP, 220/440 volt, 3 phase, 50 cycle, Frame 284, type K, 950 RPM
1—G.E. Motor 5 HP, 220/440 volt, 3 phase, 50 cycle, Frame 254, type KG
4—Main Control Panels CR-290481, 220 volt, 3 phase, 50 cycle.
Quantity of various types switches & solenoids.

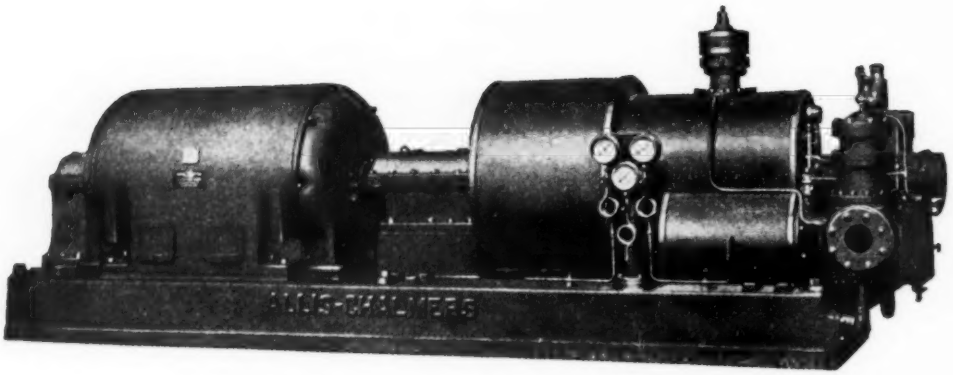
This property will be offered lot by lot and a bid for any one lot must include all the property contained in said lot.

Descriptive information including: drawings and specifications, statement of terms and conditions, forms of bids, etc. relating to the sale, may be obtained from the Office of Alien Property Custodian, 120 Broadway, New York 5, New York, Telephone—COrtlandt 7-8603.

Bid Opening: Thursday, June 15, 1944

JAMES E. MARKHAM
Alien Property Custodian

ELECTRICAL POWER EQUIPMENT



1250 KVA ALLIS CHALMERS CONDENSING TURBO UNIT

1250 KVA Allis Chalmers alternating current generator 3 phase 60 cycle 2300 volts 3600 RPM direct connected to Allis Chalmers condensing turbine 150-200 lbs. steam pressure 100 deg. superheat. Equipped with jet condenser and auxiliaries.

TURBO GENERATORS

3 phase 60 cycle

3750 KVA GENERAL ELECTRIC condensing, 200 lbs., 2300/4000 volts with surface condenser.

2500 KVA ALLIS CHALMERS condensing, 200 lbs., 2300 volts, with jet condenser.

1875 KVA ALLIS CHALMERS condensing, 175 lbs., 2300 volts, with jet or surface condenser

1250 KVA WESTINGHOUSE noncondensing 150-300 lbs., 0-75 lbs., back pressure, 480 volts

937 KVA ALLIS CHALMERS condensing, 200 lbs., 2300 volts with surface condenser

SURFACE CONDENSER

1540 sq. ft. WORTHINGTON surface condenser with steam jet air pumps

ENGINE GENERATORS

3 phase 60 cycle

500 KVA GENERAL ELECTRIC-AMES uniflow, 175 lbs., 5 lbs. back pressure, 240 volts, 150 RPM

260 KVA GENERAL ELECTRIC-SKINNER uniflow, 125 lbs., 10 lbs. back pressure, 480 volts, 200 RPM

210 KVA GENERAL ELECTRIC engine type generator, 2300 volts 225 RPM

188 KVA CROCKER WHEELER - SKINNER counterflow, 100-135 lbs., 5 lbs. back pressure, 208/120 volts 4-wire, 225 RPM

187½ KVA GENERAL ELECTRIC-SKINNER uniflow, 150 lbs., 5 lbs. back pressure, 240 volts, 225 RPM.

150 KVA GENERAL ELECTRIC-AMES counterflow, 100-150 lbs., 5 lbs. back pressure, 240 volts, 257 RPM

MOTOR GENERATORS

3 phase 60 cycle

1500 KW WESTINGHOUSE synchronous 250 volts D.C., 2200 volts A.C. 514 RPM

1000 KW GENERAL ELECTRIC 3-unit synchronous 125/250 volts D.C., 4000/2300 volts A.C., 720 RPM

500 KW GENERAL ELECTRIC synchronous 600 volts D.C., 2200/4000 volts A.C., 720 RPM

ROTARY CONVERTERS

3 phase 60 cycle

3500 KW (2) WESTINGHOUSE 225-285 volts D.C., 225 RPM, with 13200 volt transformers

1500 KW WESTINGHOUSE 250 volts D.C., 600 RPM, with 2300 volt transformers

750 KW GENERAL ELECTRIC 600 volts D.C., 1200 RPM, with 2300/4000 volt transformers

MOTORS

3 phase 60 cycle

500 HP ELECTRIC MACHINERY synchronous 2200 volts, 514 RPM

1000 HP GENERAL ELECTRIC mill type induction, 2300 volts, 514 RPM

1500 HP GENERAL ELECTRIC synchronous 2200 volts, 225 RPM

1500 HP WESTINGHOUSE slip ring 2200 volts, 435 RPM

2000 HP GENERAL ELECTRIC synchronous 2200 volts, 240 RPM

THE NATIONAL POWER MACHINERY CO.
1921 SCRANTON ROAD CLEVELAND, OHIO

MOTORS GENERATOR SETS

1—750 KW, 250 volt, Allis Chalmers, synchronous
2—150 KW, 125 volt Westinghouse, synchronous
1—75 KW, 125 volt, General Electric, squirrel cage.
1—20 KW, 600 volt, General Electric, squirrel cage induction motor.
2—15 KW, 250 volt, General Electric, squirrel cage
1—6½ KW, 125 volt, General Electric, squirrel cage.

ALTERNATORS

1—625 KVA, 3600 RPM, 600 volt, G.E.
1—250 KVA, 720 RPM, 230 volt, G.E.
1—200 KVA, 3600 RPM, 240 volt, Allis Chal.
1—62½ KVA, 3600 RPM, 220 volt, Allis Chal.

MOTORS—3 PHASE 60 CYCLE

1—500 HP, 900 RPM, Lincoln, 440 volt, slip ring.
1—400 HP, 514 RPM, 440 volt, Westg., slip ring.
1—350 HP, 300 RPM, 440 volt General Electric slip ring.
1—335 HP, 600 RPM, 2300 volt, G.E., syn.
1—300 HP, 720 RPM, 2200 volt, G.E., slip ring.
1—250 HP, 514 RPM, 4000 volt, G.E., syn.
1—250 HP, 600 RPM, 4000 volt, G.E., syn.
1—200 HP, 600 RPM, 2200 volt, G.E., sl. rg.
1—200 HP, 450 RPM, 2200/4000 v., G.E., sl. rg.
1—150 HP, 1800 RPM, 440 volts, General Electric, squirrel cage.
1—150 HP, 1750 RPM, Westinghouse, sl.rg.
1—150 HP, 1200 RPM, General Electric, squirrel cage.
1—150 HP, 900 RPM, 440 volt, Al. Ch. sl. rg.
1—100 HP, 900 RPM, 440 volt, G.E., sl. rg.
3—100 HP, 720 RPM, 440 volt, G.E., sl. rg.
1—125 HP, 720 RPM, Allis Chalmers, sl. rg.
1—100 HP, 720 RPM, 440 volt, G.E., sq. cg.
1—100 HP, 600 RPM, 440 volt, G.E., sl. cg.
1—100 HP, 514 RPM, 440 volt, G.E., sq. cg.

INSTRUMENTS

25—Westinghouse type U Recording Ammeters with slit core, CT.

25—Westinghouse type U Recording Volt-meters.

MOTORS—3 PHASE 60 CYCLE (Con't)

2—100 HP, 450 RPM, 440 volt, G.E., sq. cg.
1—90 HP, 400 RPM, 550 volt, Cr. Whlr., sq. cg.
1—75 HP, 900 RPM, 4000 volt, Elec. Mach. syn.
1—75 HP, 900 RPM, 220 volt, Fairbanks Morse, slip ring.
1—75 HP, 900 RPM, 440 volt, G.E., sq. cg.
1—75 HP, 720 RPM, 440 Volt, Westghse., slip ring.
1—75 HP, 720 RPM, 440 volt, G.E., sq. cg.
2—75 HP, 1200 RPM, 2200 volt, G.E., Vertical.
1—50 HP, 900 RPM, 440 volt, G.E., sl. rg.
1—50 HP, 900 RPM, 440 volt, G.E., sq. cg.

MOTORS—D.C. 230 VOLTS

2—450 HP, G.E., 400 RPM, Type MPL Form 1-F.
1—250 HP, 760 RPM, Electro Dynamic.
2—150 HP, Westghse., 550 RPM, Type SK.
1—150 HP, 750 RPM, Electro Dynamic.
1—125 HP, 600 RPM, Westinghouse, SK.
1—100 HP, G.E., 575 RPM.
1—100 HP, 625 RPM, G.E.
1—80 HP, Crocker-Wheeler, 600 RPM, Type CMC.
1—75 HP, G.E., 575 RPM, Type C, Sprague; with spare armature.
1—65 HP, 1000 RPM, G.E., Type RC.
8—50 HP, Crocker-Wheeler, 700 RPM, Type CM.
1—65 HP, G.E. 625 RPM Type DLC—65, Form A.
1—50 HP, 750 RPM, Westghse., Type SK.
1—50 HP, 700 RPM, Crocker-Wheeler.
1—40 HP, G.E.-Sprague, 700 RPM, Type LC.
1—40 HP, 775 RPM, Westinghouse.
1—40 HP, 300 RPM, G.E.
1—30 HP, 750 RPM, G.E., type RC.
1—30 HP, G.E., 750 RPM, Type RC-14, Form A.
130 HP, G.E., 1100 RPM, Type RC-31B, Form A-21.
1—35 HP, G.E., 650 RPM, Type RC-15.
1—30 HP, G.E., 625 RPM, Type C.
1—25 HP, Westghse., 600 RPM, Type SK.
2—25 HP, G.E., 775 RPM, Type RC-13,
1—20 HP, G.E., 800 RPM, Type RC-13, Form A.
1—15 HP, G.E., 800 RPM, Type RC-11.

TRANSFORMERS

2—400 KVA, G.E., 4156-250/480 v., Scott taps.
3—300 KVA, Pittsburgh, 7800/440 volts.
3—150 KVA, G.E., 33,000/2300/4000 Y.
3—100 KVA, Westinghouse, 11,430/250 volts.
1—100 KVA, Pittsburgh, 1375/2750-110/220 volts.
3—100 KVA, Westinghouse, 13200-250 volts.
3—75 KVA, G.E., 13,500-750/440 volts.
3—75 KVA, General Electric, 2200/220/110.
1—75 KVA, G.E., 3 phase, 4156Y—120/208Y.
3—50 KVA, G.E., 2200/220/110
2—50 KVA, Pbgh. 7500/15000 volts-110/220 volts.
3—37½ KVA, G.E., 2200/220/440.
2—30 KVA, Allis Chalmers, 3 phase, 4156Y/120/208Y.
1—25 KVA, G.E., 220/110-220/110 volts
2—15 KVA, G.E., 2300-115/230 volts.

MOTORS—VARIABLE SPEED 230 VOLTS

2—100 HP, 475/1375 RPM, Electro Dynamic.
1—90 HP, 470/940 RPM, General Electric.
1—75 HP, 525/1575 RPM, Electro Dynamic.
1—35 HP, 500/1500 RPM, Westinghouse.
1—35 HP, 350/1050 RPM, Electro Dynamic.
1—30 HP, 225/900 RPM, Crocker Wheeler.
7—25 HP, Westinghouse, 650/2200 RPM. Type SK-110L.
2—25 HP, 300/900 RPM, Electro Dynamic.
1—20 HP, 750/1500 RPM, General Electric.
1—15 HP, 300/1200 RPM, G.E.
1—13/18 HP, 350/1200 RPM, Electro Dynamic.
1—5 HP, 600/1200 RPM, General Electric.
1—5 HP, 450/1800 RPM, Crocker Wheeler.
1—5 HP, 400/1600 RPM, Diehl.
1—5 HP, 225/900 RPM, Electro Dynamic.

TURBO-GENERATORS

600 KW Terry dual bleeder condensing Turbine only.
1—500 KW, G.E., 3 ph., 60 cy., 430 volt, bleeder.
1—375 KVA, Westghse., non-condensing.
1—300 KW, G.E., 3 ph., 60 cy., 220 v., con.
1—200 KW, G.E., 3 ph., 60 cy., 220 v., cond.

Hemphill FOR POWER

J. L. HEMPHILL & COMPANY

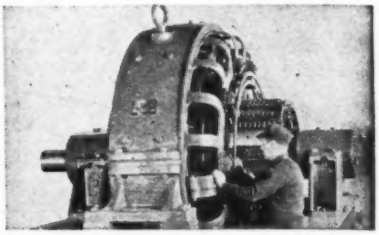
1602 53rd ST., NORTH BERGEN, N. J.

PHONE NEW YORK—LONGACRE 5-3227 NEW JERSEY—UNION 3-2600

Step Up Your Power

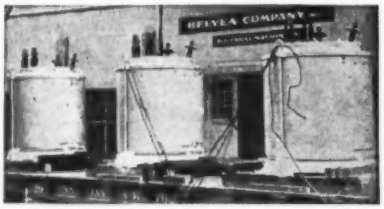
QUICK WITH

Stock Equipment



Shipped as fast as conditions allow

WRITE—Better Still—WIRE



MOTOR GENERATOR SETS

3 Phase 60 Cycle

1—1500 KW G.E., 275 V. D.C. to 2100 H.P., 2300 V.

1—1500 KW WHSE., 250 V. D.C. to 2100 HP., 440/2300 V.

1—1000 KW WHSE., 600 V. D.C. to 1400 H.P., 4000 V.

1—500 KW G.E., 600 V. D.C. to 700 H.P., 13200/6600 V.

1—400 KW G.E., 250/275 V., D.C. to 600 H.P. 2300 V.

1—350 KW G.E., 220 V., A.C. Gen. d.c. to 500 H.P., 230 V. D.C. Motor.

1—115 KW G.E., 250 V. D.C. to 175 H.P., 440 V. Ind Motor.

1—100 KW WHSE., 250 V. D.C., to 160 KVA. 2300 V.

1—75 KW G.E., 125 V. D.C. to 120 H.P., sq. cg. 2300/4000 V.

1—50 KW G.E., CD, 125 V. D.C. to 75 H.P., sq. cg., 2300/4000 V.

1—40 KW WHSE., 230 V. D.C. to 45 KVA 2300 V.

1—25 KW A. B. See 230 volt D.C. to 50 H.P. 220 volt sq. cg. motor with exciter.

TURBO GENERATOR SETS

1—500 KW Whse. 625 Kva. 440 V. 3 ph. 60 cy. 3600 RPM with Parsons 145/175 lb. cond. turbine complete with jet cond. and access.

1—75 KW Ridgeway 250 V. D.C. with Terry turbine 180 lb. pressure with 12 lb. bk. pres., 2000 RPM.

A. C. GENERATORS AND SYNO. MOTORS

3 Phase—60 Cycle

HP or KVA	Make	Type	Volts	Speed
2—2100	G.E.	ATI	2300	514
1—1000	Whse.		2300	900
1— 750	G.E.	ATI	220/440	900
1— 600	G.E.	ATI	220/440	900
1— 500	G.E.	TS	440	360
1— 300	G.E.	ATI-PB	440	600
1— 225	G.E.	ATB	220	600
1— 168	Al.Ch.		2300	900
1— 150	Whse.		4000	1800
1— 125	G.E.	ATB	220	900
1— 100	G.E.	ATB	220	720
10— 100	Whse.		2300	1800

A. C. MOTORS

3 Phase—60 Cycle

SLIP RING

HP	Make	Type	Volts	Speed
1—1200	Cr. Wh.	801Q	2300	237
1— 800	Al. Ch.	ANY	440	885
1— 800	Whse.	CW	440	357
2— 600	G.E.	IP	440/2200	720
1— 450	Whse.	HW	2200	875
1— 400	Al. Ch.	ANY	2300	505
1— 400	G.E.	IP	440/2200	600
1— 350	G.E.	MT-442	2300/4000	257
1— 300	G.E.	IM	440	720
1— 300	Whse.	CW	440	585
1— 250	G.E.	MT	4000/2300	257
1— 200	Whse.	CW	2200	514
1— 200	G.E.	I-M	440	600
1— 150	G.E.	MT 564	440	600
1— 150	G.E.	IM-17B	2200	290
1— 100	G.E.	IM	220	1750
1— 100	G.E.	MTC-5546	220/440	860
1— 100	Whse.	CW-752C	550	1160
2— 100	G.E.	IM	2200	575
1— 100	G.E.	MTC-5552	550	685
1— 80	G.E.	MTC-542	440	850
1— 75	F.M.	BY-H16B	2200	1750

SQUIRREL CAGE

HP	Make	Type	Volts	Speed
1—500	G.E.	1-17B	2200	690
1—400	Whse.	CS-1104A	2200	585
1—300	Whse.	CS	550	580
1—300	G.E.	IK	440/2300	600
1—200	G.E.	IK	2300	490
4—175	G.E.	IK	440	900
1—125	Whse.	CS	220/550	1150
1—125	G.E.	IK	220	720
1—100	Whse.	CS	550	1750
1—100	G.E.	IK-Vert.	2300	450
1— 75	Whse.	CS	550	700
3— 60	Whse.	CS-445S	2200	3550

GEAR REDUCTION UNITS

1—21 H. P. Whse. 1800/360 RPM.
1— 943 H.P. G.E. 5306/1200 RPM.
1— 450 H.P. G.E. 3600/1200 RPM.

THE BELYEA REPUTATION PROTECTS YOU!

ROTARY CONVERTERS

3 Phase, 60 Cycle

Qu.	KW	Make	Speed	DC	Trans. V.
1	1500	Whse.	720	600	2300
1	1500	Whse.	600	600	11500
1	1250	G.E.	720	250	2300
1	1000	G.E.	900	600	13200
1	1000	Whse.	600	250	22000
1	1000	Whse.	900	600	11000
2	750	G.E.	1200	600	2300
1	750	Whse.	720	250	6600/2300
1	500	Whse.	1200	600	13200/2300
2	375	G.E.	1200	250	6600/2300
2	300	G.E.	1200	600	2300

3 Phase, 25 Cycle Booster Type

2	1500	G.E.	500	225/275	13200/6600
1	500	G.E.	750	225/275	13200/6600

All units can be furnished with AC and DC controls

TRANSFORMERS

60 Cycle

KVA	Make	Ph.	Type	Voltages
6—1667	Pitts	1	OISC	13200x2300
4— 525	G.E.	1	HJ-DD	2300x445
3— 333	Maloney	1	OISC	22000/11000x2300/575
2— 333	Whse.	1	OISC	2300x460
2— 333	Pitts	1	OISC	2400x220
3— 300	G.E.	1	H	13200x2300/575
6— 200	G.E.	1	H-KS	2300/4000x115/230
3— 200	G.E.	1	HILD	26400x115/460
2— 200	G.E.	1	H-KDD	13800x220/440
3— 150	Whse.	1	SKM	2400x120/240
3— 100	Whse.	1	SK	6900x460/230
3— 100	Whse.	1	OISC	13200x250

D. C. MOTORS

HP	Make	Type	Volts	Speed
2—1250	G.E.	MPC	500	130
1— 800	G.E.	MPC	550	600
2— 625	G.E.	MPC	250	130
1— 600	G.E.	MPC	550	600/800
1— 500	G.E.	MPC	230	900
2— 300	G.E.	DMC	230	400/600
2— 300	Whse.		500	250/400
1— 300	G.E.	MPC	230	275/550
1— 300	G.E.	MPC	230	250/440
1— 250	G.E.	C	230	375
1— 250	Al. Ch.	Irt	230	525
2— 200	Whse.		230	400/500
1— 175	Whse.	SK	250	150/525
1— 150	G.E.	RC-19	230	800/1000
1— 150	Whse.	SK	230	300/900
1— 150	G.E.	MPC	230	250/450
2— 130	Cr. Wh.	CMC-65H	550	1200
2— 125	G.E.	CO-1832	230	625
2— 120	Whse.	SK	230	720
2— 100	G.E.	LC	230	1200
1— 100	G.E.	MPC	230	225/450
1— 100	Whse.	SK	230	600
1— 100	G.E.	RC-19	230	575/720
1— 75	G.E.	C	230	500/1000
2— 70	Whse.	SK-183	230	560/780
1— 60	Al. Ch.	E-146	115	1150
1— 60	Al. Ch.	E-131	115	1750
1— 60	Diehl	K-11	230	500/1000
2— 60	Cr. Wh.	CMC-65H	230	500/1000
1— 50	Cr. Wh.	CMC-81H	230	300/900
1— 50	Cr. Wh.	CMC-80H	230	380/750
9— 50	G. E.	RF-16	230	400/1600
1— 50	G.E.	RC-19	230	400/1200

RENUBILT BELYEA MOTORS

SUCCESSFUL OPERATION GUARANTEED

BELYEA COMPANY INC.

Main Office & Shop: 43 HOWELL ST., JERSEY CITY, N. J.

"PRESIDENT ROOSEVELT, PRIME MINISTER CHURCHILL, GENERAL MARSHALL,

et al, need every support heavy power can give them. The following list of quality, certified equipment is available immediately!"

WATER TUBE BOILERS

1—100,000/120,000# T.S.G. Straight Tube Sectional Steel Header Cross Drum 250# unit, 125° Superheat, steel encased, underfeed ram type stoker fired; complete going installation.

1—80,000/90,000# T.S.G. Bent Tube 350# ASME steel encased unit, designed for powder fuel firing and complete with all modern auxiliaries.

4—1000 HP Box Steel Header Straight Tube Longitudinal 3 Drum type 250# ASME 125° Superheater equipped, oil fired units; complete with all paraphernalia for re-installation.

2—750 HP Box Steel Header Straight Tube Longitudinal type 2 Drum Edgemoor units, 200#; steel encased, waste heat fired.

1—612 HP B&W Stirling 200# ASME unit, complete with all auxiliaries, self-supporting members, stoker and stack.

4—600 HP B&W Stirling units almost mate duplicates to the above unit; original design pressure 200#, now hand fired.

2—365/500 HP Edgemoor Box Steel Header 200# design units, complete with superheaters and underfeed stokers for re-installation.

2—300 HP Heine Marine type Cross Drum Steel Encased 200# ASME hand fired units, with one stack and all trimmings.

TURBOS — 60 Cycles

12,000/15,000 KVA Condensing Multi-Stage Turbo, 235#, 550° TT, 60/3/6000 volts; complete layout including 15,000 sq. ft. Westinghouse surface condenser and every standard auxiliary.

15,000/19,000 KVA Impulse and Reaction Design Condensing Turbo unit, 250#, 150° Superheat, 60/3/13,200; complete going unit including surface condenser, all auxiliaries and piping.

1—5000 KW/6250 KVA Curtis General Electric multi-stage Condensing Turbo unit, 220/225#, 125° Superheat, 60/3/2300/3600; complete with surface or jet condenser.

2—4000 KW/5000 KVA Curtis General Electric six-stage Condensing Turbo units, 60/3/2300/1800; complete with surface or jet condenser.

1—2500 KW/3125 KVA Curtis General Electric four-stage Condensing Turbo unit, 60/3/4100 (Star regroupable Delta 2300 V), 200#, 100° Superheat; complete with surface condenser.

2—2000 KW/2500 KVA Westinghouse Straight Parsons design Non-condensing Turbo units, 60/3/2300/3600, 200#, 15/20# gauge back pressure.

2—1000 KW Westinghouse Multiple Expansion Parallel, Flow Condensing Turbo units, 60/3/2300/3600; complete with surface condensers.

1—500 KW Westinghouse modern Impulse and Reaction Single Flow Steel Barrel Condensing Turbo, 200/250#, 60/3/2300/3600; complete with jet condenser.

1—500 KW Westinghouse Parsons Multiple Expansion Parallel Flow Turbo unit, 60/3/220 or 440/3600.

1—500 KW Westinghouse Parsons Multiple Expansion Parallel Flow Condensing Turbo unit, 60/3/2300/3600; with surface condenser.

2—300 KW Westinghouse Condensing Turbo units, 60/3/2300/3600; complete with jet condensers.

1—300 KW Westinghouse type ENC Single Wheel Re-entry type Condensing or Non-condensing Turbo unit, 60/3/220 or 440/3600; rebladed, rebuilt and rewound complete.

"LOYAL COOPERATION IN HEAVY POWER MOVEMENT THRU 3 WARS"

"Now in World War II—May We Confirm Intent and Ability, Face to Face?" . . . P.S.

KIEMLE OF TOLEDO, OHIO

MOTORS
GENERATORS
CONTROLS
TRANSFORMERS
MOTOR GENERATOR SETS
ETC.

BERGER OF ROCHESTER, N.Y.

Put all idle equipment to work. Send your list for prompt action.

TRANSFORMERS

3—500 KVA, GE, type H, form VD525 19100-22000/40000Y to 2300, 1 phase 25 cycle.
1—200 KVA Maloney type H.E. 2400/120/240 volts, 1 phase 60 cycle.
1—200 KVA GE, type H.K. 2300/115/230 volts, 1 PH. 60 cy.
2—250 KVA Pittsburgh, 2300/115/230 volts, 1 PH. 60 cy.
2— 75 KVA West. type S.K. 1 ph. 25 cy. 60000 volts Prim—6900/2300 volts secondary.

OTHER SIZES, VOLTAGE AND CYCLES AVAILABLE

ALTERNATORS

240 KW, 8 PF Electric Machinery, 4600 volts, 60 cycle 3 phase, 450 R.P.M. with direct connected exciter.
200 KW Westh. Unity Power Factor, 3 PH. 60 cyc. 900 R.P.M. with direct connected exciter.
150 KVA Gen. Elec. Type ATB form D, 60, 3 ph., 220/440 600 R.P.M., revolving field, built-in exciter.
150 KW Elect. Mach. Revolving fields 3 ph. 25 cy. 440 volts 750 R.P.M.
90 KW Gen. Elect. Rev. field type A.T.B., .8 P. F. 3 ph. 60 cy. 240 volts 900 R.P.M. Dir. Con. exciter.

D. C. GENERATORS

150 KW Western Elec. 3 brg. 3 wire, 115/230 V, 600 R.P.M.

MOTOR GENERATOR SETS

Western Elect. 1000 Amps—40 volts direct con. to either AC or DC 580 RPM Motor.
125 K.W. Crocker Wheeler, 250 Volts D.C. Comp. WD. Dir. Con. to G.E. 2300 or 440 Volts Sq. Cage Motor.
100 K.W. Gen. Elect. 3 BRG. 125 Volts D.C. Comp. WD. INT. with 220/440 Volts Sq. Cg. Motor.

CRANE MOTORS

75 H.P.—G. E. 51—230 Volts—550 RPM
35 H.P.—G. E. Form D—550 Volts—590 RPM
25 H.P.—Form E—550 Volts—760 RPM

2-Ton Shephard Hoist With 3-H.P. Hoist Motor and 2-H.P. Trolley Motor 3 Phase. Can Be Used Remote Control.

300 KW Gen. Elect. Synchronous Converter, 6 Phase, type HCC form J, 25 cycle 750 speed 230 volts. With Transformers for 2300 volts.

FREQUENCY CHANGERS

40 KW GE type I.T.T. frame 553 3 ph. 25/62, ½ cy. 220 volts primary 440 volts secondary, 750 R.P.M. direct con. to 40 H.P. GE hype KT543—3 ph. 25 cy. 220 volt, 750 R.P.M.

OTHERS IN ALL SIZES VOLTAGES AND CYCLES

3 ph. 60 cy. A. C. MOTORS

H.P.	Make		Type	Speed	Volts
250	West	S.C.	C. S.	900	440
200	West	Syn.	.08 P. P.	900	220/440
		WITH DIRECT CON. EXCITER			
200	Wsghse.	Sl.Rg.	CW	600	220/440
200	Wsghse.	Syn.	Dir. Con. Exc.	600	2300
200	Gen. Elec.	Sq. Cg.	1 Form K	514	220/440
200	Gen. Elec.	Syn.	ATi	514	400/2300
150	Gen. Elec	Sq. Cg.	I	600	2300
150	Al Ch	Sq. Cg.		600	440
150	Burke	Sq. Cg.	3 BRG. 2 ph.	900	220/440
125	Gen. Elec.	Sl. Rg.	NT. 553	1200	220
125	Gen. Elec.	Sq. Cg.	I K	720	220/440
25	Gen. Elec	Sq. Cg.	I. K. Vert.	720	220

3 ph. 25 cy. MOTORS

H.P.	Make		Type	Speed	Volts
830	Elec. Mach.	Syn.	Dir. Con. Exc.	500	2300
350	Gen. Elec.	Sl. Rg. 3 Brg.	I	375	440
200	Lincoln	S. R.	I. X. W.	500	440
150	Burke	Syn.	Dir. Con. Exc.	500	440
150	Gen. Elec.	Sl. Rg.	I Form M	500	2200
100	Wagner	Sl. Rg.	BR	750	220/440
100	Gen. Elec.	Sl. Rg.	I Form M	750	220/400
100	Gen. Elec.	Sq. C.	I K	750	220/440
100	Wsghse.	Sq. C.	CS	500	220/440
75	Wsghse.	Sq. C.	CCI.	500	220/440
75	Gen. Elec.	Sl. Rg.	I M	750	220/440
75	Wagner	Sq. C.	BM	750	2200
75	Gen. Elec.	Var.	BTA	375/750	440
50	Burke	Syn.	AC 133	750	220
		WITH DIRECT CON. EXCITER			

230V D. C. MOTORS

H.P.	Make	Type	Speed
150	West	SK 180L Comp. Wd. Int.	1150
125	G.E.	CL	850
100	Northwestern	K30 Comp. Inter.	1750
85	Gen. Elec.	Vert. Comp. Wound	700
75	Crocker Wh.	CCM25JA	1700
67	Otis	Elevator Motor Comp. wd.	1200
60	Sprague	D—Comp. Wound	625
50	Gen. Elec.	C. L. 6 Shunt Wound	560
40	Fair. Morse	Ball BRG. Vert. Comp.	1740
32	Sturtevant	C Form P, Shunt Wound	190

Only partial listing

OVER 10,000 ITEMS IN STOCK FOR IMMEDIATE DELIVERY FROM EITHER ROCHESTER, N. Y. OR TOLEDO, OHIO REBUILT AND SOLD WITH A STANDARD NEW GUARANTEE.

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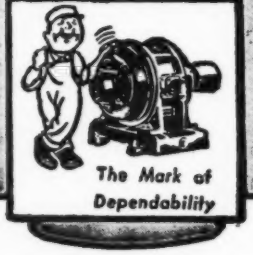
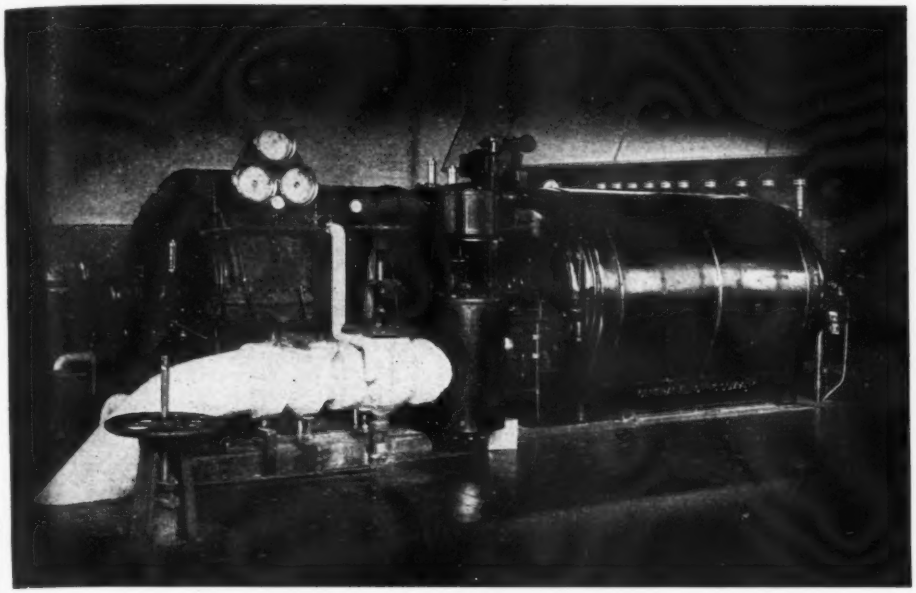
ROCHESTER NEW YORK



THE FRED W.
KIEMLE CO.
33 N. SUPERIOR ST.
TOLEDO OHIO

3125 KVA CONDENSING TURBINE-GENERATOR UNIT



ACTUAL PHOTOGRAPH

AVAILABLE IMMEDIATE DELIVERY

3125 KVA — 2500 KW 80% P.F. General Electric, 3 phase, 60 cycle, 2300 volt, 3600 RPM condensing turbine-generator unit, 180-200# I.S.P. 500° T.T., equipped with surface condenser, panels and instruments.

Excellent condition—a complete installation.

TURBINE-GENERATOR UNITS

3 phase, 60 cycle

1875 KVA G.E. condensing 175-200 lb. pressure, 500° T.T. 6600 volts. 3600 RPM complete with condenser.

937½ KVA G.E. automatic extraction condensing, 175 lb. pressure, 125°F. superheat, 15 lb. gauge, 2300 volts, 3600 RPM—complete.

625 KVA G.E. condensing 200 lb. pressure, 2300 volts, 3600 RPM complete with condenser and auxiliaries.

375 KVA G.E. condensing 150-200 lb. pressure, 100° SH, 2300 volts, 3600 RPM complete with surface condenser and auxiliaries.

375 KVA (2) G.E. non-condensing, 150-175 lb. pressure, 5 lb. back pressure, 2300 volts, 3600 RPM each complete with direct connected exciter.

125 KVA G.E. non-condensing, 110-125 lb. pressure, 0-10 lb. back pressure, 240 volts, 3600 RPM complete with switchboard.

ROTARY CONVERTERS

1500 KW Westinghouse synchronous 250 volts, direct current—6 phase, 60 cycle alternating current, 514 RPM.

750 KW G.E. synchronous, 600 volts direct current, 6 phase, 60 cycle alternating current, 1200 RPM.

330 KW G.E. synchronous, 600 volt direct current, 6 phase 60 cycle alternating current, 1200 RPM with 2300 to 408 volt transformers.

ENGINE-GENERATOR UNITS

Direct Current

1000 KW Westinghouse, 250 volts, 514 RPM generator direct connected through reduction gear to Westinghouse condensing turbine, 150-200 lb. pressure, equipped surface condenser.

600 KW Crocker-Wheeler, 250 volts, 300 RPM generator direct connected to a 14" x 18" 4 cylinder Ames vertical Unaflow non-condensing engine, 150-175 lb. pressure, 5 lb. back pressure, complete with switchboard.

400 KW Crocker-Wheeler, 250 volts, 150 RPM generator direct connected to a 26" x 32" Skinner Unaflow non-condensing engine.

250 KW G.E., 250 volts, 150 RPM generator direct connected to a 20" x 28" Chuse non-releasing Corliss engine complete with switchboard.

75 KW 125 volt, 1800 RPM Westinghouse direct current non-condensing turbine-generator unit.

75 KW, 125 volt, 2400 RPM Allis Chalmers-Terry non-condensing turbine-generator unit.

ENGINE-GENERATOR UNITS

3 phase, 60 cycle

Alternating Current

625 KVA Allis (2), 440 volts, 150 RPM generator direct connected each to a 26" x 30" Hamilton Corliss engine, 125-150 lb. pressure.

375 KVA G.E. 2300 volts, 200 RPM generator direct connected to a Chuse cross compound 4-valve non-releasing Corliss engine.

312 KVA G.E. 2300/480 or 240 volt, 200 RPM generator direct connected to a Chuse 4-valve non-releasing Corliss engine.

312 KVA Elliot 4000/2300/550 or 240 volts, 180 RPM generator direct connected to a 17" x 24" Elliott Unaflow non-condensing engine, 175 lb. pressure, 6 lb. back pressure.

250 KVA Westinghouse, 2300 or 480 volts, 200 RPM generator direct connected Nordberg Unaflow engine.

MOTORS

—3 phase, 60 cycle

900 HP G.E. 240 volts, 900 RPM synchronous.

500 HP 80% P.F., G.E., 240 volts, 900 RPM synchronous motor with direct connected exciter.

125 HP 80% P.F. Elec. Mchy, 440 volts, 400 RPM synchronous.

60 HP G.E. 220 volts, 900 RPM squirrel cage induction complete with starting compensator.

50 HP G.E. type I, form M, 2200 volts, 1200 RPM slip ring.

50 HP Allis-Chalmers, 440 volts, 600 RPM squirrel cage.

SYN. MOTORS

3 phase, 25 cycle

1700 HP G.E. 2300 volts, 300 RPM.

910 HP Westgh. 2300 volts, 300 RPM.

MOTOR GENERATOR SET

1500 KW Allis-Chalmers, 600 or 275 volt direct current generator direct connected to 2190 HP, 3 phase, 60 cycle, 4000/6600 volt, 300 RPM synchronous motor.

FREQUENCY CHANGER SETS

750 KVA Westinghouse, 3 ph., 60 cy., 2300 v. alternating current generator dir. con. to 910 HP, 3 ph., 25 cy., 2300 v., 300 RPM syn. motor.

1200 KVA General Electric, 3 ph., 60 cy., 2400 v. alternating current generator dir. con. to 1700 HP, 3 ph., 25 cy., 2300 v., 300 RPM syn. motor.

SPECIALS

500 KVA G.E. 3 phase, 60 cycle, 2300 volt, 450 RPM belted generator.

165 KW Electric Machinery, 3 phase, 60 cycle, 2400 volt, 514 RPM belted generator.

22" x 48" Nordberg Corliss belted type engine, 150 to 175 lb. pressure, 100 RPM.

SYNCHRONOUS CONDENSERS

1350 KVA

Total Capacity

750 KVA and 600 KVA G.E. type ATI, 3 phase, 60 cycle, 240 volts, 900 RPM synchronous condensers each complete with direct connected exciter, switchboard panel with instruments. Are in A#1 operative condition — still on original foundation for operating test.

Utilities Electrical Machinery Corporation

600 NATIONAL CITY BANK BLDG.
CLEVELAND, OHIO

WIRE OR PHONE
LONG DISTANCE 422

L. J. LAND AND COMPANY

MOTORS & GENERATORS

SOLD WITH A ONE-YEAR GUARANTEE

DIRECT CURRENT

(Partial List Only)

230 VOLT DC MOTORS

H.P.	Make	Speed
150	West.	600
60	El. Dynam.	900
60	Roth	600
60	G.E.	480/1100 (2)
50	West.	550/1100
50	Cr. Wh.	700 (2)
50	G.E.	850
45	Diehl	850/1020
40	El. Dy.	1200
40	Cr. Wh.	915
35	West.	1150
25	Diehl	850/1020
25	G.E.	1150
25	G.E.	575
20	Cr. Wh.	1750
20	R & M	1160
20	G.E.	1150 (4)
20	West.	1150
20	G.E.	800 (2)
15	West.	1250
15	G.E.	1150 (3)
15	Cr. Wh.	900/1800
15	West.	850
10	West.	850 (2)
10	G.E.	825 (3)
10	G.E.	700
10	Al. Ch.	600/1800
10	West.	600/1200
10	G.E.	400/1600
10	West.	400/1200 (2)
9	G.E.	450/1800
8½	Diehl	900
8½	West.	850
8½	West.	350/1400
7½	Sturt.	3600
7½	Peerl'e	1700
7½	West.	1450
7½	West.	1150 (2)
7½	G.E.	1150
7½	West.	975
7½	Al. Ch.	850
7½	El. Dy.	550/1650
7½	Watson	525/1150
7½	G.E.	400/1600
7½	West.	400/1600
7½	Al. Ch.	350/1050
7½	G.E.	300/1200
6	G.E.	400/1200
6	G.E.	450/1800 (2)
5½	West.	500/1500 (2)
5	West.	850
5	G.E.	900 (2)
5½	G.E.	400/1600
5	West.	1800
5	G.E.	1700
5	G.E.	1150 (2)
5	West.	1100
5	Al. Ch.	1150
5	Cont.	600/1800
5	West.	850
5	G.E.	850
5	Star	600/1200
5	El. Dy.	550/1650
5	G.E.	450/800
5	G.E.	600
5	G.E.	450/1350
5	West.	400/1200
5	El. Dy.	275/1100
4	G.E.	850/1150
3½	West.	850/1600
3	West.	1700
3	West.	1150 (6)
3	Roth	500/2000
3	G.E.	500/1500
2½	West.	480/1800

236 additional 230 volt D. C. Motors in stock as small as 1/20 H.P.

115 VOLT DC MOTORS

H.P.	Make	Speed
90	G.E.	900
20	West.	200/900
15	West.	1100
15	Cr. Wh.	800
10	L. Allis	3500
10	West.	850
10	El. Dy.	425/1275
7½	G.E.	850 (2)
6	Burke	650
5	Cr. Wh.	1875
5	West.	1100 (2)
5	Cr. Wh.	960

75 additional 110 volt Motors down to 1/6 H.P.

BELTED AND MOTOR DRIVEN DC GENERATORS

100 KW West.	125 volts
100 KW West.	250 volts
96 KW G.E.	60 volts
75 KW West.	250 volts
60 KW G.E.	600 volts
60 KW G.E.	125 volts
50 KW West.	125 volts
48 K West.	30 and 60 volts
45 KW West.	250 volts
30 KW El. Dy.	600 volts
40 KW Cr. Wh.	125 volts
30 KW West.	125 volts
25 KW West.	125 volts
25 KW G.E.	250 volts
20 KW G.E.	125 volts
15 KW West.	125 volts

43 additional Motor Generator Sets, 30 volts, 60 volts, 125 volts, 250 volts, and 250 volts as small as ½ K.W.

ALTERNATING CURRENT

(Partial List Only)

2 & 3 PHASE SLIP RING

H.P.	Make	Speed
250	G.E.	600
200	West.	580
200	G.E.	495
125	West.	1175
125	Burke	580
112	G.E.	900
100	F. M.	690
75	West.	1170
75	Al. Ch.	575
64	G.E.	585
60	West.	1135
60	West.	290
50	Ideal Vert.	1740
50	G.E.	870 (2)
50	West.	850
40	Wagner	1150
40	F. M.	870 (2)
40	West.	870
40	Linc.	690
30	G.E.	870
30	G.E.	690
15/35	West.	6/1200 (5)
25/55	G.E.	6/1200
20/50	West.	6/1200
25	Al. Ch.	870 (2)
25	West.	850
25	G.E.	870 (2)
25	G.E.	720
25	West.	575
20	G.E.	870
20	West.	575

116 additional Slip Ring Motors in stock down to ½ H.P.

3 PHASE SQUIRREL CAGE MOTORS

H.P.	Make	Speed
200	G.E.	600
150	G.E.	860
147	West.	715
100	G.E.	1200
100	West.	1750
100	West.	720
100	G.E.(BTA)	375/750
75	West.	870
50	West.	1200
50	G.E.	900
50	Al. Ch.	690
40	G.E.	900
35	Wagner	850
30	U. S.	3450 Vert.
30	West.	1750 Vert.
30	Al. Ch.	514
25	Wagner	1200
25	West.	1140
25	Diehl	865 (3)
25	G.E.	900
25	Wagner	720
20	G.E.	1750 (3)
20	G.E.	1200 (2)
20	Cr. Wh.	1200 (2)
20	Al. Ch.	900 (2)
20	Diehl	900 (3)
20	G.E.	720
20	West.	1720
15	Cr. Wh.	1700
15	G.E.	1200 (3)
15	Wagner	720
15	G.E.	600
10	G.E.	720 (5)
10	G.E.	3450
10	West.	1150

325 additional three phase Motors down to ¼ H.P.

TWO PHASE SQUIRREL CAGE MOTORS

H.P.	Make	Speed
75	Cr. Wh.	870
50	Linc.	900
50	G.E.	900
40	G.E.	900
40	Al. Ch.	900
35	Al. Ch.	900
30	West.	1200
25	G.E.	1200
20	West.	1150
15	G.E.	1200
15	F & M	900
10	G.E.	1200
10	G.E.	900
7½	G.E.	900
7½	G.E.(BQS)	600/1350
5	G.E.	900
5	Al. Ch.	1200

146 additional two phase Motors down to ¼ H.P.

SINGLE PHASE MOTORS

H.P.	Make	Speed
20	Wagner	1160
20	Cent.	1165
7½	Cent.	3500

38 additional single phase Motors.

AC GENERATORS

150 KW G.E.	720
100 KVA West.	600
75 KVA West.	900
25 KVA West.	1200

New York City's Largest Stock Electrical Machines

ESTABLISHED 1910

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SPECIAL

10—15 H.P. 4-speed constant horsepower 600/900/1200/1800 RPM Ball Bearing Motors.

10—4 speed Allen-Bradley Magnetic Starters

General Electric
Westinghouse
Louis Allis.

REBUILT POWER EQUIPMENT

READY TO SHIP!

MOTOR GENERATOR SETS

1200 kw. G.E. 275 v. 720 rpm., 4100 v., 3 ph. 60 cy. syn.
1000 kw. G.E. 250 v. 720 rpm., 4150 v., 3 ph. 60 cy. syn.
1—150 KW Ridgway 250 v. 900 rpm. 2200 v. 3 ph. 60 cy. syn.

25 CY. MOTORS—220/440 V. A.C.

HP	Make	Type	RPM
40	Al. Chal.	AN	750
35	G.E.	I-M	500
30	Al. Ch.	AN	750
25	Westg.		750
1	Westg. (vert.)	CSA	750

SLIPRING MOTORS—3 PH., 60 CY.

H.P.	Make	Volts	R.P.M.	Type
20	G.E.	220	865	
20	Westg.	220	1735	CW
20	Cr. Wh.	220	850	
20	G.E.	220	1200	MT
30	Westg.	220	540	MW
40 to 50	Westg.	440	1150	CW
40	G.E.	220/440	720	MT542
50	Al. Ch.	440	900	ANY
50	Westg.	440	1150	CW636A
50	Westg.	440	1145	HF
50	G.E.	440	900	MT-542
50	Chandeys'n	220/440	1800	
50	G.E.	220/440	1200	HI
50	Westg.	400	850	HF
50	Allis Chal.	220	490	
62	Westg.	220/440	1135	
75	Cr. Wh.	220	870	
75	Cr. Wh.	220	870	
75	G.E.	440	900	ITC
75	Westg.	400	840	HF
75	Westg.	220/440	690	CW
75	G.E.	440	1800	ITC-M
75	G.E.	220	900	
100	Westg.	2200	900	CW
100	G.E.	2200	450	I-M
100	Westg. (Ball Bearing)	220	720	CW-854
104	G.E.	220/440	720	IM-10
125	Fair Morse	440	1800	
150	West.	2200	580	CW
150	G.E.	220	375	I-8
185		2300	900	
200	G.E.	2200	575	I-12
200	G.E.	2200	600	I
200	Westg.	220/440	580	CW
260	Burke	440	600	EMV-65
300	G.E.	2200	585	1-17B
300	G.E.	2200	1770	
300	G.E.	440	900	I
300		2300	720	
350	Westg.	2200	900	CW
400	Westg.	2300	580	CW
400	Westg.	2200	435	CW-1214
600	G.E.	550	150	I
600	G.E.	2200	600	MT-12
1000	Westg.	2300	720	CW
1500	Westg.	2200	435	CW

ALTERNATING CURRENT MOTORS 3 ph. 60 cy.

H.P.	Make	Volts	R.P.M.	Type
30	U. S. Elec.	220/440	1800	SC
30	G.E.	220/440	1760	
30	Burke	440	1200	EM3
30	Westg.	220	1120	CX
30	G.E.	220 only	900	I
30	Triumph	220	1200	B11
30	G.E.	220/440/550	720	I-8
30	G.E.	220	685	
30	Line. Elec.	220	600	
30	A. E. C.	440	600	vertical
30	Duquesne	440	600	
30	Westg.	220	514	CS
30	Allis Chal.	220	900	
30	Triumph	220	525	TR-138
30	Western	220	900	
35	Lincoln	220	720	
35	G.E.	220	900	18
35	G.E.	440	1200	I
35	Westg.	440	685	CS
35	Al. Ch.	550	1200	
40	G.E.	220/440	1765	
40	Howell	220	900	SO
40	G.E.	220/440/550	1200	I-8
40	G.E.	220	1165	vertical
40	Reliance	440	900	
40	Line. Elec.	220	900	
40	Westg.	440	900	C
40	Wagner	440	720	
40	Al. Ch.	440	720	
40	Westg.	440	600	C
40	Westg.	220	514	CS
40	Am'n Elec. (Enclosed-ball bearing)	440	685	PK
40	West.	220	600	CS
40	G.E.	220/440	1160	K
40	Duquesne	220/440	850	
50	West.	2200	575	CS
50/150	West.	2200	360/720	CS-954
50	Westg.	440	1800	C
50	American	220	1200	PK
50	Wagner	440	850	
50	Western El.	220	570	KT-346
50	Chandeys.	220/440	1800	
50	Duquesne	440	1200	
50	A. E. C.	440	900	vertical
50	Westg.	220	720	
50	Westg.	220	514	CS
50	Reliance	440	1200	
50	Allis Chal.	440	1800	AN
50	West.	440	1120	C
50	Westg.	220	900	CS-752C
50	G.E.	220/440	1200	HI
50	Westg.	440	690	C
50	Westg.	440	345	CS
50	Allis Chal.	2200	865	
50	Westg.	220	1800	
50/32	G.E.	440	800/640	
50/60	G.E.	440	1200	I
54	Allis Chal.	440	900	
60	Westg.	440	1800	C
60	Duquesne	440	1800	
60	Wagner	440	1200	
60	Al. Ch.	440	1200	
60	Westg.	220	720	CS
60	Allis Chal.	440	1800	AN
60	Westg.	440	1750	CS
75	West.	220/440 (Linestart)	3550	CS-W445S
75	Louis Allis Adjusto speed—splash proof—ball bearing	220/440	1770	505Y
75	Wagner	440	1800	
75	Westg.	220	870	CS
75	G.E.	220	700	H3A
75	G.E.	220/440	1150	I-8
75	Westg.	220	600	CS
75	G.E.	220	900	I-8
75	Cr. Wh.	220	514	124Q
75	West.	2300/200/440	1200	syn.
100	Westg.	220	720	MS
100	G.E.	2200	450	I
100	G.E.	220	900	KT356
100	G.E.	220	700	KT356
100	Allis. Chal.	220	600	
100	Cr. Wh.	220	575	124QB
100	G.E.	440	400	I-K
100	Westg.	220	1200	CS-vertical
100	G.E.	2300	580	I-15
100	Westg.	440	700	CS
125	Allis Chal.	220	800	
125	Westg.	2300	1170	CS
125	G.E.	440	450	I
125	G.E.	220/550	400	I
125	Cr. Wh.	220	720	124QB
125	Allis Chal.	440	695	
125	Allis Chal.	2200	1165	ARV
150	West.	220/440	327	Syn.
150	West.	2200	720	CS-954
150	Wagner	440	1800	31V
150	G.E.	220	575	V-15-A
150	G.E.	440	514	I
150	G.E.	220/550	450	I
150	G.E.	550	575	I-K
150	G.E.	2200/220/440	450/243	
150	Westg.	2200	327	LC-Syn.
175	G.E.	2200	600	I-12
200	Westg.	440	1700	CS
200	Westg.	2200	900	
200	G.E.	220/550	514	I
300	G.E.	220	1750	KT-563
400	West.	2200/220/440	500	CS
500	G.E.	220/440	1170	KTP-567
800	G.E.	6600	1200	
1000	G.E.	2300	509	K
1500	G.E.	2200/220/440	225	AT1-Syn.
2000	G.E.	2200/220/440	240	TS-Syn.
9000	G.E.	6600	107	AT1

VARIABLE SPEED MOTORS—230 VOLT D.C.

H.P.	Make	R.P.M.	Type
½	Reliance	550/2000	
½	Northern	700/2000	
1	Reliance	550/2000	
1	Westg.	300/600	SK-53
1½	Westg.	740/2200	SK-10
1½	Reliance	500/1000	14T
2	G.E.	400/1600	
2	G.E.	415/830	R1C
2	G.E.	500/2000	
2¼	Westg.	450/900	SK-30
2½	G.E.	500/1000	RLC
2½	Reliance	500/1000	14T
2½	West.	600/1200	SK-30
2¾	Westg.	900/1800	SK
3	Westg.	650/1950	SK
3	Jantz-Liest	650/1950	BI-DC
3	Westg.	450/900	SK
3	Roth (Enclosed)	500/1000	R8
3	West.	650/1950	SK-33
3	West.	850/1700	SK-33
3¼	West.	400/1600	SA
3½	Westg.	850/1700	
3½	Reliance	300/600	
5	West. (Enclosed)	400/1600	SK-110L
5	Allis Chal.	450/1800	E-90
5	West.	400/1600	SK-100L
5	Reliance	300/1800	21
6	Roth	500/1000	R8
7½	Westg.	450/900	80L
7½	Reliance	650/1300	550v.
7½	Westg.	1125/2905	SK-43
7½	West.	400/1600	SK-100L
7½	West.	400/1600	SA
10	Westg.	565/1130	S-6
10	G.E.	625/1250	LC
10	West.	400/1600	SA
10	West.	400/1600	SK-100L
10	West.	850/1700	SK-70
10	West.	500/1000	SK-70L
15	Louis Allis	1150/1750	NA
15	Reliance	500/1800	
15	West.	850/1700	SK-90
15	Westg.	675/1350	SK-100L
20	Westg.	900/1800	SK-100L
20	G.E.	270/540	
20	Westg.	750/1500	SK-110L
20	Westg.	750/1125	SK
30	G.E.	450/900	RLC
35	G.E.	375/1600	1C
50	G.E.	600/1200	500 v
75	West.	475/950	SK-180
75	West.	400/650	SK-181

TRANSFORMERS—1 ph. 60 cy.

No.	Kva.	Pri. Sec.	Make	Ph.
5	2	1040/2080	115/230	G.E.
1	3	4160/2400	120/240	G.E.
1	3	2400	120/240	G.E.
1	3	1040/2080	115/230	G.E.
1	3	2200	220/440	West.
1	2	2200	110/200	G.E.
1	2	440	110/220	Westg.
1	3	2400/4100	120/240	G.E.
1	3	2400	120/240	G.E.
15	5	220	110	G.E.
45	5	1100/2200	122/244	G.E.
21	5	2200/1100	110/220	West.
87	5	2200/1100	110/220	G.E.
101	7½	2200/1100	110/220	G.E.
43	7½	2200/1100	110/220	West.
50	7½	1100/2200	122/244	G.E.
27	7½	220	110	G.E.
30	7½/10	440	110/220	G.E.
19	10	2200/1100	110/220	West.
48	10	2200/1100	110/220	G.E.
42	10	1100/2200	122/244	G.E.
45	10	220	110	G.E.
2	15	400/30000/50000		Amer.
45	15	440	110/220	G.E.
15	15	4160	110/220/440	G.E.
12	15	2200	110/220/440	G.E.
27	20	2200	110/220/440	G.E.
30	20	4160	110/220/440	G.E.
1	25	460	180	Pgh.
1	25	1100/2200	110/220	G.E.
1	37½	2300	110/220	Wag.
3	50	6600	575	G.E.
3	50	6600	575/440/220	G.E.
4	50	6600	575/440	Allis.
4	60	11430/6600	550	Al Ch.
6	73	440	220	West.
6	73	440	205	West.
1	75	2200	220—3 ph.	Burke
3	100	6600	220/440/550	Pgh.
1	100	2200	110/220—3 ph.	G.E.
1	140	2300		
		Furnace Trans. 60-80 and 100 v. taps.		
1	150	2200	110/220	G.E.
1	200	2200	110/220	G.E.
1	250	11000/22000	110/220/440	Pgh.

INDUSTRIAL TRUCKS

1—Baker Tow Truck with batteries.

CHAIN BLOCKS—with or without trolleys

2—Chisholm Chain Blocks 2 tons
2—Ford Triblock—2 ton
4—Ford Triblock—3 ton
1—Phila.—3 ton

HOISTS

2—New Shaw Monorail Load Lifters—2000 lbs.—25' lift, 2 HP, A.C. Motors, push button control
1—2 ton Shepard 250 v. D.C. complete with trolley and cable

INDUCTION MOTOR GENERATOR SETS

250 Volts Compound Wound, D. C.—3 Ph., 60 cy. Motors

KW	Make	RPM	AC Volts
2	Crocker Wheeler	1750	220/440
3	Westinghouse	1150	220/440
5	Allis Chalmers	1150	220/440
7½	Allis Chalmers	1150	220, 440
25	Westinghouse	1150	220/440/550
10	General Electric	1150	220/440
15	Westinghouse	1150	220/440
20	Westinghouse	1150	220/440
35	Westinghouse	850	220/440
90	Reliance	1150	220/440
110	Crocker Wheeler	720	2200/440/550
150	Crocker Wheeler	580	220/440
75	Westinghouse	435	2200
75	Westinghouse	435	440/220

COAL CONVEYOR

Link Belt Vertical Coal Conveyor, bucket type, approx. 80 ft. good for 100 FPM, hoists 25 TPH, all new buckets and gears complete with 20 HP AC motor.

D.C. CLARK CONTROLLER

1—250 HP Clark Vari-time magnetic controller 230 v. DC reversing, used for plugging service. Can also be used non-reversing.

GEAR MOTOR

20 HP Louis Allis Gear Motor, 220/440 v. 3 ph. 60 cy. 1750 rpm. with speed reducer motorized planetary speed reducing transmission, driven speed approx. 14 rpm. totally enclosed, fan cooled.

A.C. GENERATORS

125 KVA West., 220/220/440 v., 3 ph., 60 cy., 327 rpm.
150 KVA Wagner, type BF, 600 rpm., 440 v., 3/60.
200 KW. West. 2200/220/440 v., 3 ph., 60 cy., 200 rpm.
250 KW Al. Ch., 480 v., 150 rpm., 3 ph.
360 KVA West. 220 v., 3 ph., 60 cy., 360 rpm.

Large Stock—CIRCUIT BREAKERS—METERS — CURRENT AND POTENTIAL TRANSFORMERS—POTHEADS—RELAYS—METERS — SAFETY SWITCHES — DISCONNECT SWITCHES — U-RE-LITES — PULLEYS — REACTORS.

WRITE, WIRE OR PHONE YOUR ELECTRICAL REQUIREMENTS—SEND FOR STOCK LIST.

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DUQUESNE ELECTRIC & MFG. CO.

PITTSBURGH 6, PA.

THE PICK OF POWER EQUIPMENT

TURBO UNITS—60 Cy.

1—15300 KVA Westinghouse Cond.
1— 6250 KVA General Electric Cond.
1— 4000 KW General Electric Cond.
1— 4000 KVA Allis Chalmers Cond.
1— 3125 KVA General Electric Cond.
1— 3125 KVA Westinghouse Cond.
1— 2500 KVA Allis Chalmers Cond.
1— 2500 KVA Westinghouse Cond.
1— 1563 KVA General Electric Cond.
1— 1563 KVA Westinghouse Extrac.
1— 1250 KVA General Electric Cond.
1— 937 KVA General Electric Cond.
1— 750 KVA General Electric Cond.
1— 1250 KVA General Electric Non-C.
1— 938 KVA West. 375# I.P. 100# B.P. N-C.
1— 625 KVA General Electric Non-C.
1— 500 KVA Westinghouse Non-C.
1— 470 KVA Westinghouse Non-C.
1— 312 KVA Moore Non-Condensing
1— 250 KVA Westinghouse Non-C.
1— 125 KVA Westinghouse Non-C.
1— 107 KVA Westinghouse Non-C.

STEAM ENGINE UNITS—60 Cy.

1—1067 KVA Nordberg Uniflow
1— 375 KVA Nordberg Uniflow
1— 325 KVA Skinner Uniflow
1— 300 KVA Hamilton 4-valve
1— 210 KVA Skinner Uniflow
1— 187 KVA Skinner Uniflow
1— 150 KVA Skinner Uniflow
1— 100 KVA Skinner Uniflow
1— 94 KVA Ridgway 4-valve
1— 93.8 KVA Skinner Uniflow
1— 60 KVA Skinner Uniflow

D.C. STEAM ENGINE UNITS

1—350 KW Ridgway 4-valve 250 V.
1—300 KW Skinner Uniflow 250 V.
1—250 KW Ames Uniflow 250 V.
1—150 KW Ames Uniflow 125 V.
1—125 KW Ridgway 4-valve 250 V. 3-wire
1—100 KW Elliott 4-valve 250 V. 3-wire

OIL & GAS ENGINE UNITS—60 Cy.

1—625 HP Worthington, 240 V. gen.
1—610 HP Campbell, 2400 V. gen.
1—600 HP West, (gas), 480 V. gen.
1—520 HP Busch Sulzer, 2400 V. gen.
1—375 HP Worthington, 240 V. gen.
1—360 HP Anderson, 2300 V. gen.
1—360 HP Fair.-Morse, 2400 V. gen.
1—300 HP Worthington, 2300 V. gen.
1—283 HP Coop.-Bess., 230 V. gen.
1—175 HP Sterling (gas), 480 V. gen.
1—170 HP Coop.-Bess., 240 V. gen.
3—160 HP Coop.-Bess., 216 V. gen.
1—145 HP Superior, 220 V. gen.
1— 90 HP Gen.-Motors, 120/208 V. gen.
1— 57.5 HP Caterpillar, 120/208 V. gen.

SURFACE CONDENSERS

1—20,000 sq. ft. Worthington
1—12,000 sq. ft. Worthington
1— 5,000 sq. ft. Westinghouse
1— 4,100 sq. ft. Ross
1— 2,310 sq. ft Wheeler C. & E.

WATER TUBE BOILERS

1—850 HP B. & W. 250-lb., Stoker
1—750 HP Edge Moor 200-lb.
1—612 HP Stirling 250-lb., Pulverizer
2—612 HP Stirling 200-lb., Stokers
1—600 HP Union 250-lb., Stoker
2—560 HP Erie City 460-lb.
1—500 HP Stirling 250-lb., Stoker
1—500 HP Stirling 200-lb., Stoker
1—335 HP B. & W. 200-lb.
2—300 HP Heine 200-lb.
4—200 HP B. & W. 200-lb., Hand Fired

A.C. GENERATORS

2—1500 KVA G. E. 25 Cy. 2200 V. 750 RPM
2—1250 KVA G. E. 60 cy. 480 V. 750 RPM
1— 750 KVA G. E. 60 cy. 230-460 V. 300 RPM
1— 680 KVA G. E. 25 cy. 13200-4000 V. 300 RPM
1— 500 KVA G. E. 60 cy. 2300 V. 360 RPM
1— 360 KVA West. 60 cy. 240 V. 360 RPM
1— 94 KVA G. E. 60 cy. 2300 V. 600 RPM
1— 48 KW Elec. Mcy. 60 cy. 2400 V. 1200 RPM

SYNCHRONOUS MOTORS

2—1250 HP G.E. 25 cy. 2200 V. 750 RPM
2—1125 HP G. E. 60 cy. 480 V. 720 RPM
1— 850 HP G.E. 25 cy. 13200-4000 V. 300 RPM
1— 800 HP G. E. 60 cy. 440 V. 120 RPM
1— 770 HP G. E. 60 cy. 230-460 V. 300 RPM
1— 620 HP G. E. 60 cy. 440 V. 164 RPM
1— 150 HP West. 60 cy. 2200 V. 600 RPM
1— 100 HP G. E. 60 cy. 2300 V. 240 RPM (Super)

INDUCTION MOTORS—60 Cy.

4—3500 HP G.E. slip ring 2300 V. 120 RPM
1—1000 HP G.E. sq. cage 2300 V. 509 RPM
1— 600 HP G.E. sq. cage 440 V. 900 RPM
2— 400 HP G.E. slip ring 3800 V. 1800 RPM
2— 300 HP G.E. sq. cage 440 V. 600 RPM
2— 250 HP G.E. sq. cage 2300/4000 V. 1200 RPM

MOTOR GEN. SETS—60 Cy.

1—1500 KW Allis Chalmers 600 V. DC
1—1000 KW General Electric 600 V. DC
1—1000 KW Westinghouse 250 V. DC
1— 75 KW General Electric 125 V. DC
2— 75 KW Westinghouse 125 V. DC

ROTARIES—60 Cy.

1—1500 KW Westinghouse 250 V.
2—1000 KW Westinghouse 250 V.
2— 750 KW General Electric 600 V.
1— 750 KW Westinghouse 225/275 V.
1— 500 KW General Electric 250 V.
1— 500 KW General Electric 600 V.

FREQUENCY CHANGERS

2—3125 KVA West. 25/62½ cy. 750 RPM
1—3000 KVA G.E. 60/25 cy. 300 RPM
1—2500 KVA West. 25/60 cy. 300 RPM
1—1875 KVA G.E. 25/60 cy. 300 RPM
2—1250 KVA G.E. 25/62½ cy. 750 RPM
1—1250 KVA G.E. 25/60 cy. 300 RPM
1— 750 KVA G.E. 25/60 cy. 300 RPM
1— 750 KVA G.E. 60/25 cy. 300 RPM

SYN. CONDENSERS—60 Cy.

1—5000 KVA West. 5000 V. 720 RPM
1—2000 KVA C.W. 11000 V. 600 RPM
2—1250 KVA G.E. 480 V. 720 RPM
1— 750 KVA G.E. 230-460 V. 300 RPM
1— 500 KVA West. 2200 V. 900 RPM

TRANSFORMERS—1 Ph. 60 Cy.

1—10000 KVA West. 120,000/66000-13200 V. 3 ph.
3— 2500 KVA Pitts. 66000-25400/12700 V.
1— 1500 KVA Pitts. 66000-33000 V. 3 ph.
3— 750 KVA Pitts. 66000/33000 V.
3— 200 KVA G.E. 66000-13200/22800 V.
6— 250 KVA Penn. 34500-4600/2300 V.
4— 150 KVA Pitts. 33000-2300/4600 V.
3— 75 KVA G.E. 33000-13200/11000 V.
2—10000 KVA West. 26400-4580 V. 3 ph.
1— 6000 KVA West. 26400-2300 V. 3 ph.
1— 6000 KVA West. 13200-2300 V. 3 ph.
3— 1500 KVA Pitts. 22000-6600 V.
2— 1000 KVA G.E. 23000/11500-575 V.
6— 833 KVA G.E. 22000-2300/4000 Y V.
3— 667 KVA Packard 23000-440 V.
3— 250 KVA G.E. 22000-11000 V.
6—1667 KVA Pitts. 13200-2300 V.
5— 1000 KVA G.E. 13200-2300 V.
3— 200 KVA G.E. 13200-2300 V.
7— 667 KVA Moloney 11000-2300 V.
3— 150 KVA Pitts. 11000-2400 V.
3— 100 KVA West. 11000-250/125 V.
3—1250 KVA G.E. 6600-550 V.
3— 150 KVA Al.Ch. 2400/4800 V.

VOLTAGE REGULATORS
60 Cycle Induction

6—96 KVA 400 A. 2400 V. Gen. Elec.
1—72 KVA 300 A. 2400 V. Gen. Elec.
2—46 KVA 200 A. 2300 V. West.
6—36 KVA 150 A. 2400 V. Gen. Elec.
6—24 KVA 100 A. 2400 V. Gen. Elec.

OIL CIRCUIT BREAKERS

2— 400 A. 74 KV G.E. FKO36 Outdoor
1— 400 A. 73 KV G.E. FHKO36 Outdoor
1— 800 A. 37 KV G.E. FHKO136 Outdoor
6— 400 A. 37 KV G.E. FHKO136 Outdoor
4— 400 A. 34.5 KV Condit D-16-A Outdoor
2—1000 A. 30 KV Kelman CB76 Outdoor
4— 600 A. 15 KV G.E. FKO60B Outdoor
2— 400 A. 15 KV G.E. FHKO136 Outdoor
2— 600 A. 25 KV West. B-13 Indoor
1—2000 A. 15 KV West. E6 Indoor
1—1500 A. 15 KV West. E6 Indoor
2—1500 A. 15 KV G.E. FK12 Indoor
3— 600 A. 15 KV G.E. FK32G Indoor
6—1200 A. 4.5 KV Condit D-12 Indoor
2—1000 A. 4.5 KV Condit D-12 Indoor

PARTIAL LIST—WE HAVE ALL CLASSES OF POWER EQUIPMENT

BREW, WOLTMAN & CO., INC.

50 CHURCH STREET, NEW YORK CITY 7, NEW YORK

PARTIAL LIST OF OUR COMPLETE STOCK FOR IMMEDIATE SHIPMENT

PUMPS

G.P.M.	Head	Make	Type
9700	110′	Ing. Rand	Centrif.
6000	33′	LeCourtenay	Centrif.
3500	140′	Kingsford	Centrif.
2500	150′	Goulds	Centrif.
1500	180′	Penna.	Centrif.
400	625′	LeCourtenay	Centrif.
250	525′	LeCourtenay	Centrif.
300	500′	Goulds	Triplex
175	500′	Worth.	Teiplex
500	175′	Blackmer	Rotary
450	231′	Kinney	Rotary
300	150′	Viking	Rotary
200	175′	Blackmer	Rotary
1000	460′	Knowles	Steam
500	460′	Knowles	Steam
2000	50′	Lawrence	Sump
300	231′	Gardner	Plunger

GENERATOR SETS BOILER FEED PUMPS

K.W.	Make	Volts	Type
25	Green Eng.	220	Belt Drive
17	Sturt. Turb.	110	Direct Drive
7½	Sturt. Turb.	110	Direct Drive
5	Kohler Gas	110	Direct Drive

MOTORS (D. C.)

100	Northwest	220	1750
25	Imperial	220	450

STORAGE TANKS

5 to 3000 gal. Steel Welded
5 to 1000 Gal. Steel Press.
15 to 300 Gal. Conden. Tanks

CONDENSATION RETURN UNITS

Nash-Jenn Dup. Vac. Heat. 26000EDR
Nash-Jenn Sump Vac. Heat. 16000EDR
Condensation Units 100 to 250,000EDR

AIR COMPRESSORS

C.F.M.	Pressure	Make	Type
850	100	Laidlaw	Hor. Dup.
500	60	Ind. Rand	Steam
400	125	American	Horiz.
350	40	Worthing	Horiz.
250	100	Sullivan	Horiz.
220	100	Gardner	Gas Eng.
28	5000	Norwalk	4-Stage

TURBO-CENTRIFUGAL BLOWERS

3000	16 lbs.	In. Rand	Motor dr.
3000	8 lbs.	In. Rand	Motor dr.
2300	3 lbs.	Spencer	Motor dr.
950	24 oz.	Spencer	Motor dr.
900	5¼ lbs.	In. Rand	Motor dr.
700	2½ lbs.	Allen Billmyer	Motor dr.
675	24 oz.	Spencer	Motor dr.
250	16 oz.	Spencer	Motor dr.

BLOWERS

C.F.M.	St. Pres.	Make	Type
100-60000	¼"-5"	Buffalo	Various
100-15000	¾"-16 oz.	American	Various

ROTARY PRESSURE BLOWERS

C.F.M.	Press	Make	Type
10000	2 lbs.	Roots	Belt dr.
6000	3 lbs.	Roots	Belt dr.
3000	3 lbs.	Roots	Belt dr.
2000	3 lbs.	Sturt.	Belt dr.
1000	3 lbs.	Roots	Belt dr.
200	5 lbs.	Baker	Dir. dr.
110	15 lbs.	Beach R.	Belt dr.

VACUUM PUMPS

1000	15 in.	Roots	Belt dr.
350	27 in.	Worth.	Belt dr.
300	27 in.	Nash	Belt dr.
100	27 in.	Deane	Belt dr.
200	29 in.	Devine	Belt dr.

MOTORS (3 ph. 60 cy.)

H.P.	Make	Volts	Speed	Type
300	G.E.	2300/4000	1800	Syn.
175	G.E.	440	1150	I
100	Lincoln	220	1750	
50	Wagner	220	850	Syn. 2 ph
50	G.E.	2300	1750	I
50	West.	220	850	CCL
50	West.	220	570	CS
40	G.E.	220	870	342
30	G.E.	220	1750	312
30	Wagner	220	850	sl. rg.
30	Wagner	220	1150	

STEAM ENGINES

Turb. Cent. Bronze Pumps
Valves—Reducing Valves
10"x10" Greenfield Vertical
7"x7" Wickes Bros. Vertical
6"x6" Lawrence Vertical
1 to 40 H.P. Steam Turbines

SIMILAR EQUIPMENT IN STANDARD MAKES AND SMALLER SIZES
HIGHEST PRICES PAID FOR YOUR IDLE EQUIPMENT

SUPERIOR EQUIPMENT CO.

140 Grand St., N. Y. C. Tel. CAnal 6-6983-4

SPECIAL • • TURBO-GENERATOR • • SPECIAL

6250 KVA Westinghouse Turbo-Generator Set: Turbine 3600 RPM, 200 lbs pressure, 125° Superheat, complete with condenser, Pump and Air Washer. Generator: 6250 KVA 3 Phase 60 Cycle 2300 Volt 3600 RPM with turbo exciter and Motor Generator Exciter.

• • • • • •

MOTORS

230 VOLT DC

CONSTANT SPEED

Qu.	H.P.	Make	Type	RPM
1	450	Al. Ch.	Int	425
1	125	G.E.	DLC	550
1	100	Al. Ch.	CPD Int	1000
1	100	Rel.	1060T	500
1	75	G.E.	DLC	525
2	50	West.	SK100	565
1	40	G.E.	RC15A	700
1	30	West.	SK120	975
2	30	G.E.	RC31B	1150
1	30	West.	SK140	600
2	25	West.	SK120	925
8	25	G.E.	RC31	1150
1	25	West.	SK	850
1	20	G.E.	RC11	1150
3	15	G.E.	RC10	1150
5	15	West.	SK 100 I	675
7	15	Rel.	92 T TE.BB	850
2	15	West.	SK90	850
4	15	G.E.	RC11	850
8	10	G.E.	RC29	1150
8	10	G.E.	RC28	950
3	10	West.	SK80	750
2	7½	G.E.	RC	1150
9	5	West.	SK40	850

VARIABLE SPEED

Qu.	H.P.	Make	Type	RPM
3	150	Diehl	K15	400/800
1	110	West.	SA	650/1050
1	100	West.	SA	250/350
1	75	G.E.	LC	650/900
2	40	G.E.	LC	650/1300
3	30	West.	SK140	600/1200
1	25	West.	SK	400/1200
1	15	West.	SA9	300/1200
2	15	West.	SK	500/1500
2	10	Al. Ch.		500/1000

SQUIRREL CAGE

A.C. 3 PH. 60 CYCLE 2300 VOLT

Qu.	H.P.	Make	Type	RPM
1	150	G.E.	IK	900
1	100	G.E.	IK	514

220/440 VOLT

Qu	HP	Make	Type	RPM
2	250	Gen. Elec.	IK	1760
1	200	Al. Ch.		1750
1	125	Cr. Wh.	125Q	900
1	75	Al. Ch.	Splash proof	1200
1	75	Al. Ch.		600
1	50	Wagner	22 VRM	600
1	50	Gen. Elec.	KT	900
1	40	Rel.		900
5	30	Wagner	19 VRM	720
2	25	Al. Ch.		860
2	20	Al. Ch.		1740
2	20	Rel.	120 AA	900
1	20	Rel.	178 AA	720
1	15	Gent.	SCN 19	1200
1	15	Gen. Elec.	KT	900
3	10	Gen. Elec.	KT	1200
1	7½	Al. Ch.		1150
1	5	Al. Ch.		860
3	3	Imp.	TE BB	3600
1	1½	Gen. Elec.	K	1720
5	1	Wagner	BB	1200

MAGNETIC STARTERS

2 to 50 HP. 230 V. DC. Large Stock specially priced.

TRANSFORMERS

60 CYCLE, SINGLE PHASE

3—100 KVA Pittsburgh 2400/240/120 oil.
4—5 KVA Wsghse. 2300/230/460 air.
6—3 KVA G.E. 2300/230/115.

WATER WHEELS and GENERATORS

2—45" HERCULES Cylinder Gate Type B Water Wheels. Complete with Governors, pumps, and tanks. Each direct-connected to a WESTINGHOUSE ELECTRIC Vertical Generator 800 KVA, 3 ph., 600 V. 40 cy. 150 R.P.M.

GENERATORS

230 VOLT DIRECT CURRENT

750 KW Ridgway 1800 RPM Cpd. Int.
100 KW Ft. Wayne MPL 550 RPM.
100 KW G.E. MPL 600 RPM.
200 KW Sprague 525 RPM.
200 KW West. 500 RPM.
250 KW West. 500 RPM.

MOTOR GENERATOR SETS

50 KW Westnghs. 125 V. DC. 900 RPM. direct conn. to 75 HP. 440-3-60 Motor.

BOILERS

4—1010 HP. Heine Watertube Boilers complete with Superheaters, Bethlehem Dahl Oilburners, all valves, Piping and fittings.
2—684 HP Edgemoore Waste Heat Boilers 200 lbs. pressure with Economizers, super-htrs., motor driven blowers and steel stacks.
2—500 HP. Edgemoore 200 lbs. press. ASME Code, with Riley side dump stokers.
2—316 HP. Heine Watertube Boilers 160 lbs. pressure.

STOKERS

UNDERFEED

2—West 7 Retort 750 HP. rated capacity
1—Jones 3 Retort 316 HP. rated capacity.
Steam actuated. Will operate at 200% of rated capacity.

CONDENSER

1—C. H. Wheeler 3650 Sq. Ft. Surface Cond. 2 pass. complete with pumps.

SPEED REDUCERS

6—Jones Herringbone 50 HP. Ratio 93.5 to 1.
1½ HP. G. & F. Worm Gear Type, ratio 10.26 to 1.
15 HP. DeLaval Worm Gear Reduction. Unit ratio 12 2/3 to 1.

WRITE US ABOUT YOUR POWER REQUIREMENTS

TURBO-CENTRIFUGAL PUMPS

Terry Steam driven Turbine centrifugal pump, type GF, turbine 710 H.P., 145 lb. steam pressure, 60 lb. back-pressure, 3581 RPM direct connected thru Gear Unit 1000 RPM; type U Allis Chalmers Centrifugal Pump 18" x 18", 13,000 GPM at 170' head, 1000 RPM.
1—Lawrence Machine 3 stage pump 550 GPM, 418' head. With Elliott Turbine, 200 H.P., 2400 RPM, 170 lbs. initial, 12 lbs. back pressure
1—Lawrence Machine 8" Circulating Pump. With Lee Turbine, 50 H.P., 2100 RPM, 150-250 lbs. initial, 10 lbs. back pressure
1—Lawrence Machine 6" Circulating Pump. With London Steam Turbine, 40 H.P., 2200 RPM, 150 lbs. initial, 10 lbs. back pressure
1—Lawrence Machine 5 stage pump 150 GPM, 635' head. With Lee Turbine, 80 H.P., 2600 RPM, 200 lbs. initial, 10 lbs. back pressure
1—Lawrence Machine 5 stage pump 200 GPM, 635' head. With Lee Turbine, 85 H.P., 2650 RPM, 175 lbs. initial, 10 lbs. back pressure

PUMPS OR TURBINES MAY BE PURCHASED SEPARATELY

CENTRIFUGAL PUMPS

2—Lecourtenay 5" all bronze centrifugal pumps 500 GPM at 90' head direct connected to Allis-Chalmers 20 H.P. Motor 440, 60, 3, 1740 RPM.
2—Lecourtenay 12" Iron Casing Motor Driven Centrifugal Pumps, type 12BT8, 5,000 GPM at 148' H., Direct connected to G.E. 250 HP. Motor, type IE15 form K, 440, 60, 3, 1760 RPM.
Lecourtenay 12" Iron Casing Motor Driven Centrifugal Pump, 4,500 GPM at 135' H. 1750 RPM Direct Connected to Allis-Chalmers 200 H.P. Motor 440, 60, 3, 1750 RPM.
8—Gould Centrifugal Pumps 270 GPM. 30' H. Direct Driven by 5 H.P. A.C. Motor.
Cameron Centrifugal Purchased New 1923. Bronze fitted, mounted on common subbase for motor drive—
1—Size 14—700 RPM 4700 GPM 35' head 60 H.P.
1—Size 14—720 RPM 5500 GPM 30' head 75 H.P.
1—Size 16—350—RPM 3500 GPM 45' head 125 H.P.
All Pumps Tested Hydrostatically for 125 lbs.
All Double Suction Volute, Gate Valves Attached.
1—Gould Triplex Pump 5 x 8.

STEEL STORAGE BINS

Sizes up to 35,000 cbft.

CONVEYORS AND BUCKET ELEVATORS

MISCELLANEOUS

FEEDWATER HEATER: 5,000 HP. Cochrane open type.
OVERHEAD CRANES: One 25 Ton overhead hand-operated.
One 15 Ton overhead 50' span traveling crane, electric lift; hand travel.

HEAT and POWER Company

45 BOND STREET Phone: Algonquin 4-3874 NEW YORK 12, N. Y.

1—400 HP Westinghouse, type CW, 3 ph. 60 cy, 440V, 450 RPM slip ring motor

1—250 HP General Electric, 3 ph, 60 cy, 440V, 1-17 400 RPM

1—150 HP Electric Mach. syn. motor, 125 KVA, 3-60-220V, 1200 RPM

1—150 HP General Electric, 3-60-440V frames 17A 360 RPM slip ring

1—150 HP Westinghouse, 2 ph, 60 cy, 440V frame 1000, CW. 390 RPM slip ring

4—100 HP General Electric, 3-60-440V, 495 RPM, MT 562 slip ring

2—100 HP General Electric type I, form K, 3-60-220V 575 RPM

50 KW Westinghouse, 125/250 V, type SK, frame 160, 3 wire generator direct connected to a 100 HP General Electric, type KT356, 900 RPM, 3 PH, 60 CY, 220 V motor on fabricated base.

1—100 HP Westinghouse, type CCL, 3 ph, 60 cy, 2200V, 1750 RPM, Squirrel Cage

1—100 HP Allis-Chalmers, type ANY, 3 ph, 60 cy, 220V, 690 RPM slip ring

1—100 HP General Electric, 3 ph, 60 cy, 4000V, 720 RPM syn., type TS with direct connected exciter

2—100 HP Crocker Wheeler, size 2AQ, 3 ph, 60 cy, 440V, 385 RPM slip ring

1—100 HP Westinghouse, type CS, 3 ph, 60 cy, 440V, 1750 RPM sq. cage

2—75 HP 300 foot head Pumps: 2200V Fairbanks-Morse, 1800 RPM 3 ph, 60 cy, slip ring motors direct connected to 500 GPM 3 stage

1—75 HP Allis-Chalmers, 3 ph, 60 cy, 440V 450 RPM slip ring

1—75 HP Fairbanks-Morse, type H, frame 165C, 3 ph, 60 cy, 550V, 900 RPM Squirrel Cage

1—75 HP Lincoln, type IQ, 2 ph, 60 cy, 440V, 600 RPM Squirrel Cage

1—75 HP Allis-Chalmers, 3 ph, 60 cy, 440V, 600 RPM slip ring

1—75 HP General Electric, 3 ph, 60 cy, 440V, 600 RPM, MT558 slip ring

1—75 HP Western Elec. type I, 3-60-440V, 690 RPM

2—75 HP Allis Chalmers, 3 ph, 60 cy, 440V, 860 RPM slip ring

1—60 HP Lincoln 3-60-220V frame IXM, Sq. Cage, 900 RPM

1—60 HP General Electric, 3-60-440V, 720 RPM, type I, form K

1—60 HP General Electric, 3-60-440V, 1750 RPM, type I slip ring

1—60 HP Westinghouse, 3 ph, 60 cy, 220V, 1160 RPM, type CS-644C

1—50 HP Wagner (Fynn Weichsel) 3-60-440V, 1200 RPM

1—50 HP General Electric 3-60-220V, 1150 RPM, type I, slip ring

2—G.E. factory built syn. M-G sets 230 KW, 125V, 600RPM generator driven by 335HP, 4600V syn. motor complete with starting equipment and panels.

1—50 HP Triumph 3-60-440V, type C12, 1150 RPM, slip ring, rotor & stator rewound

1—50 HP General Electric, 3-60-440V, 900 RPM, type I-M, slip ring

1—50 HP Howell 3-60-440V, 870 RPM, type SCBB ball bearing Sq. Cage

1—50 HP General Electric, 3-60-440V, 720 RPM, type IK, Sq. Cage

2—50 HP Allis-Chalmers 3-60-440V, 690 RPM slip ring

1—50 HP General Electric 3-60-440V, 690 RPM, MTS 46, slip ring

1—50 HP Ideal 3-60-440V, 580 RPM, type AV, slip ring

1—50 HP Wagner 3-60-440V, 495 RPM, type BM, Sq. Cage

1—50 HP Allis-Chalmers, 3-60-440V, 490 RPM, Sq. Cage

1—50 HP General Electric 3-60-440V, 490 RPM, type I-M, slip ring

1—50 HP Westinghouse CS 2-60-440V, 420 RPM, Sq. Cage

1—50 HP Allis-Chalmers, 3 ph, 60 cy, 220V, 1160 RPM, type AR-220D

1—50 HP Howell, 3 ph, 60 cy, 440V, 1165 RPM, type SC50-4, ball bearing

1—50 HP Allis-Chalmers, 3 ph, 60 cy, 550V, 860 RPM sq. cage

1—50 HP General Electric, type I-M, 3 ph, 60 cy, 440V, 720 RPM slip ring

1—45 KVA Fairbanks Morse, 3 ph, 60 cy, 220V, 1200 RPM alternator

2—30 HP Fairbanks-Morse, 3 ph, 60 cy, 2220V, 3600 RPM, type HO, frame 12B ball bearing

We have a stock of 3000 motors from 1 HP to 50 HP in AC and DC. We have a very large stock of air circuit breakers up to 12000 amp.

2—175 HP, 230V, DC Westinghouse, type SK, 150 to 550 RPM

1—100 HP General Electric, type CD, fr. 123, 230V, 1200 RPM

1—60 HP Westinghouse, type SK140L, 115V, 1150 RPM vertical

1—50 HP Westinghouse, type SK, fr. 160, 230V, 565 RPM

1—50 HP Westinghouse SK200, 230V, 250/900 RPM

1—DC Generator 45KW Bullock, 120V, 375A, 900 RPM

2—40 HP C & C 230V, 250/1000 (planer)

2—40 HP, G. E., 3 ph, 60 cy, 440V, 435 RPM, type 1-13A

25 CYCLE MOTORS

1—50 HP Westinghouse 3-25 cy-440V, 720 RPM, type MS, Sq. Cage

1—50 HP General Electric, 3-25 cy-440V, 700 RPM, type I-M, slip ring

1—40 HP Westinghouse 3-25 cy-440V, 730 RPM, type CI, frame 753A slip ring crane

1—35 HP Allis-Chalmers 3-25 cy-440V, 720 RPM, slip ring

1—30 HP Westinghouse 3-25 cy-440V, 720 RPM, CS. Sq. Cage

The Wente Electric Co.,

Hamilton, Ohio

REBUILT MOTORS & GENERATORS SINCE 1906

STEAM PUMPING ENGINES

1—**Snow** 6 mgd. C&FW Cr. Com. Opp. Type Cond. 20-40x14¾x36, with waterworks type cond.

1—**Allis-Chal.** 4 mgd. cr. com. cond. Size 12x28x13x34. Fine cond.

PUMP VALVES

Birch Valves for all types of of reciprocating pumps.

LARGE GATE VALVES

1—20" Rensselaer #13 Iron Body Bronze Mounted Hub End Gate Valve with 16" Iron Brass Lined Hydl. Cyl. with indicating Rod and Eyebolt, 100#

1—20" Crane 125# Flanged Hand Wheel operating Gate Valve.

BIRCH MANUFACTURING COMPANY

1523 Sedgwick St. Chicago, Ill.

GOOD VALUES ALWAYS

200 KVA 257 rpm Engine type Alternator.
80 and 150 HP 125/150 lb. HRT Boilers.
80 HP Vertical 125 lb. Steam Boilers.
2500 KVA 2300 volt Condensing Turbine.
500 KW Uniflows, 1 each A.C. and D.C.
180 & 270 HP Worthington 2300 V. Diesel.
30 ton Plymouth Std. Gauge Diesel Locomotive.
Model WLD, six wheel.
1¼ yd. P&H, 45 or 65 ft. boom.
350 HP Modern Fairbanks 2300 V. Diesel Generator Set.
2—250 HP 1800 rpm Slip Ring Motors, 2300V.
Several small steam Engine Units.

Mississippi Valley Equipment Co.

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A. C. GENERATORS

10—62.5 KVA General Elec. 220/127 Volts Type ATI, 3 ph. 60 cyc. 80% P.F. 1200 R.P.M. Revolving Field with Exciter.
8—37.5 KVA General Elec. 220/127 Volts Type ATI 3 ph. 80% P.F. 1200 RPM Revolving Field with Exciter.
5—25 KVA General Elec. 220/127 Volts 3 ph. Type ATI, 80% P.F. 1200 RPM Revolving Field with Exciter.
10—18.75 KVA General Elec. Type ASI, 120/240 Volts, 1 ph. 1200 RPM, 80% P.F. Revolving Field with Exciter.

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Motors, Generators, Alternators, Frequency Changers

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2—60 H.P.
FAIRBANKS MORSE
DIESEL GENERATORS
A.C.—1200 RPM.

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FOR SALE

1—4000 ft. Compressor; 1800 sq.ft. Heater
1—400 KW 250 V. DC Gen. D/C Unaflow Eng.
1—150 KW 125/250 V. Gen. D/C 4-Val. Eng.
1—250 & 168 KW AC Gens. D/C Unaflows
1—750, 2—214 & 180 HP Full Diesels
1—75 KVA 440-3-60-Gen. D/C Engine
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450 H.P. BUCKEYE GENERATOR UNIT
"O"
6 CYLINDER
13½ x 15½
360 RPM
300 KW 3/60/480—2300

262 H.P. BUCKEYE POWER UNIT
"E"
7 CYLINDER
9½ x 14
400 RPM
OBB & V SHEEVES
175 KW 3/60/480

3–150 H. P. BUCKEYE GENERATOR SETS
"E"
4 CYLINDER
9½ x 14
400 RPM
1—OBB & V SHEEVE
2—100 KW 3/60/240-2400

240 H.P. BUCKEYE GENERATOR UNIT
"70"
5 CYLINDER
10 x 12
514 RPM
150 KW 3/60/240

190 H.P. BUCKEYE GENERATOR UNIT
"70"
4 CYLINDER
10 x 12
514 RPM
125 KW 3/60/480

40-60 & 100 H.P. BUCKEYE GENERATOR SETS
"J"
2—3 & 4 CYLINDER
7½ x 10½
514 RPM
30—50 & 65 KW 3/60/240

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PORT WASHINGTON, LONG ISLAND, N. Y.
ROSLYN 1220

TURBO GENERATORS

1—1000 KW 3 phase 60 cycle 480 volt 3600 rpm General Electric non condensing with board
1—750 KW General Electric
1—500 KW General Electric
1—300 KW General Electric
1—400 KW Moore extraction type

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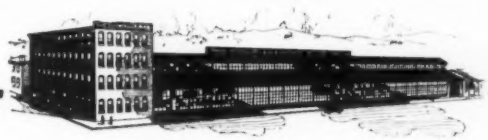

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We will pay cash for like surplus equipment.

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MOTORS • GENERATORS • TRANSFORMERS

Prices on Application

3 PHASE, 60 Cycle, 220/400 V.

HP	Make	RPM	Type	Frame
7½	Gen. Elect.	1200	KT	952
10	Gen. Elect.	720	K	404
10	Gen. Elect.	900	KT	312
15	West.	1800	CS	
20	Gen. Elect.	900	KG	405
20	Armor	900	ball bearing	
20	Fairbanks Morse	900	ball bearing	
25	Westinghouse	900	CS	444
30	Armor 2-phase	720	ball bearing	
40	Westinghouse	1800	CS	
50	Gen. Elect.	1800	IK	
50	Westinghouse	900	CS	505
50	Westinghouse	900	CS	646A
50	Gen. Elect	720	KT	546
50	West.	1800	CS	
60	Gen. Elect.	1800	I	form K
75	Gen. Elect.	1800	I	form K
75	Gen. Elect.	900	KT	552
100	Gen. Elect.	1800	I	form K
100	West.	1800	CS	
150	Gen. Elect.	1200	I	form K
150	Gen. Elect.	1200	I	form K

TRANSFORMERS

Amt.	Kva.	Make	Cycle	Voltages
3	25	Gen. Elect.	25	2300/115/230
3	50	Gen. Elect.	25	2300/115/230
3	75	Gen. Elect.	60	4600/230/460
3	100	Gen. Elect.	25	2300/115/230/460
3	100	Pittsburgh	60	12000/2300
2	100	Pittsburgh	60	2300/230/460
3	100	Westinghouse	60	2300/230/460
2	150	Westinghouse	25	2300/115/230/460
3	200	Gen. Elect.	60	2300/230/460
3	250	Gen. Elect.	60	13,000/2300
2	333	Westinghouse	60	2300/230/460
3	500	Pittsburgh	25	11,000/220
4	833	Allis Chalmers	25	13,200/440
2	1500	Westinghouse	60	4000/2300-230
6	1667	Allis Chalmers	60	7200/12,470/2400 /4160

SPECIAL D.C. MOTOR

20—60 HP, Gen. Elect. DC. Variable Speed Motor 230 V. Type DMC. 6, Form A, 180-900 RPM with Controls.

MOTORS

3 PHASE, 25 CYCLE, 220/440 VOLTS

HP	Make	RPM	Type	Frame
1	Gen. Elect.	750	KT	926
2	Gen. Elect.	750	KT	731
2	Gen. Elect.	1500	KT	934
2	Gen. Elect.	1500	K	225
3	Gen. Elect.	1500	KT	944
5	Gen. Elect.	750	KT	948
5	Gen. Elect.	750	KT	181
5	Gen. Elect.	1500	KT	948
7½	Gen. Elect.	750	KT	302
7½	Gen. Elect.	1500	KT	954
10	Gen. Elect.	750	KT	512
10	Gen. Elect.	1500	K (Ball bearing)	364
15	Gen. Elect.	750	KT	323
15	Gen. Elect.	750	KT	523
15	Gen. Elect.	1500	KT	303
20	Gen. Elect.	750	KT	327
25	Gen. Elect.	750	KT	333
25	Gen. Elect.	1500	KT	527
30	Gen. Elect.	750	KT	343
40	Gen. Elect.	750	KT	543
40	Westinghouse	1500	CS	6458
40	Gen. Elect.	750	KT	347
50	Gen. Elect.	750	KT	353
50	Gen. Elect.	1500	I	Form K
75	Gen. Elect.	750	KT	357
100	Gen. Elect.	500	IM	Slipring
100	Gen. Elect.	300	I	Form K
150	Gen. Elect.	375	I	Form K
200	Gen. Elect.	500	IM	Slipring
200	Westinghouse	235	CW	Slipring
300	Westinghouse	500	CW	(22,000) Slipring
350	Westinghouse	500	CW	(2200 v.) Slipring
400	Westinghouse	500	CW	Slipring
500	Gen. Elect.	500	MT	(2200 v.) Slipring
700	Gen. Elect.	500	ATI	(11,000 v.) Sync.
1150	Gen. Elect.	375	ATI	(2300 v.) Sync.

Mine Slope Hoist

1—Connellsville Mfg. and Mine Supply Hoist storage capacity for 11,000 feet 1" Rope—Speed 900' per minute.
Motor 500 HP Gen. Elec. Mt. Slipring 3/60/2200/450 RPM. Complete with remote control. Herringbone reduction gears and demountable base and drum.
Write Wire Phone

Prices on Application

SLIPRING MOTORS

60 CYCLE, 3 PHASE, 220/400 VOLTS

HP	Make	Speed	Type	Frame
10	Gen. Elect'	1800	MT	303
15	Gen. Elect.	1800	I	form M
20	Gen. Elect.	545	MT	332
20	Westinghouse	575	CW	648A
20	Westinghouse	575	CW	ball bearing
25	Westinghouse	690	CW	
30	Gen. Elect.	1800	MT	327
30	Gen. Elect.	1800	I	form M
40	Westinghouse	690	CW	748
40	Westinghouse	690	CW	748A
40	Westinghouse	690	CW	784A
40	Westinghouse	690	CW	748A
50	Westinghouse	900	CW	
60	Westinghouse	720	CW	2200 volt
75	Westinghouse	1800	CW	
75	Gen. Elect.	900	MT	546
500	Westinghouse	600	CW	
1000	Gen. Elect.	300	I	form M

MOTOR GENERATOR SETS

1—125 KW Ridgeway 250 V. DC. 1200 RPM Motor 3/440/60/1200 Complete.
1—100 KW Westinghouse Synchronous-Generator 250-275 V. DC—Motor 3/60/2300/900 RPM complete with panels.

FREQUENCY CHANGER SET

1—1250 KVA Gen. Elec. Synchronous—motor 3/25/2200 750 RPM direct connected to Generator 362½/440 V. Complete with exciters and panels.

200 KW., 25 CYCLE, M. G. SET

200 KW. Gen. Elect. Generator, 240 V. DC. 750 RPM. Type MPC. on Factory Base direct connected to 300 HP. Gen. Elect. Type I Form K. 3/25/440 V. 750 RPM. Complete with Motor Starting Equipment and DC. Panels.

ERIE ELECTRIC CO., INC.

124 CHURCH ST. BUFFALO, N. Y. CL. 4758

CHICAGO ELECTRIC—GUARANTEED REBUILT EQUIPMENT

2—1500 KW MGS.
2—1500 KW Wtg. 250 d.c. dir. conn. 2250 hp. Syn. 360 rpm. 3-60-12000/2300 V.

MOTOR-GENERATOR SETS

Kw	Make	DC volts	AC volts
1500	Wtg.	250	2300 syn.
1500	G.E.	280	3/60/4100 syn.
1000	G.E.	600	4400/2200
1000	Wtg.	275	4160/2300
750	G.E.	275	440
250	G.E.	600	"
200	3-unit	80v. DC	250 v. DC
235	Westg.	110	2200
225	Ideal	115	2200
200	Westg.	250	440/2200
200	Elliott	115 v.	2204
150	Cr. Wh.	250	2300
150	Ideal	250	440
150	Rldg.	250	2300
150	Wtg.	250 v.	3/60/2200 syn.
150	Rdgwy.	250 v.	3/60/2300 syn.
150	3-unit	90v.ea.	4000 syn.
100	G.E.	250	2200
100	Westg.	125	2200
100	Westg.	250	220/440/2200
90 HP	Westg.	110	75 Kva 2200 ac
75	G.E.	250	220
75	G.E.	125	220
75	G.E.	250 v.	3/60/220 syn.
60	Ideal	250 v.	3/60/220 Ind.
50	G.E.	250 v.	3/60/220 Ind.
15	G.E.	230	220
15	Ster.	240	220
7½	Jenny	balance set	

SLIP RING MOTORS

Qu.	HP	Make	Type	Speed
2	800	Westg.	CW	507
1	500	G.E.	MT	450
1	350	G.E.	MT	500
1	300	G.E.	I-M	514
1	350	Al. Ch.		300
1	300	G.E.	IE	293
1	200	Hl. ribrg.		600
1	150	Wtg.	CW	1200
1	150	G.E.	MT558	900
1	150	Al. Ch.		580
1	150	G.E.	IM	575
1	150	G.E.	IM	435
1	125	Wtg.	CW	1750
1	100	Wtg.	CW	1160
1	100	G.E.	MT-256	900
1	100	G.E.	IM	600
1	100	Wtg.	HF	230
1	75	Ntwtrn.		1740
1	75	Wtg.	CW	1750

2—1500 KW M.G. SETS

2—1500 KW Westinghouse, interpole, 250 volts, D.C. generators, speed 360 RPM. with commutating interfield poles, connected to

2—2250 KVA Westinghouse synchronous motors, 3 phase, 60 cycle, 12000/2300 volts, 300 RPM, with DC and AC switchboard equipment, excellent condition, available immediately.

FREQUENCY CHANGER

1—1400 HP General Electric type ATI-24-1250M-300 Form C, 3 ph. 60 cy. 460 volt, 300 RPM, 1570 amps. 1250 KVA, 0.9 P.F. synchronous motor with amort. wdg., dir-conn. to 1000 KW General Electric types ATI-10-1250 M-300, 3 ph. 25 cy. 450 volts, 300 RPM, 1570 amps. 1250 KVA, 0.8 P.F. A.C. generator with amort. wdg., with 33 KW G.E. 125 volt direct connected exciter. (This is a three brg. unit suitable for operation from either end.)

SLIP RING MOTORS

1	75	Al. Ch.	ARY	900
1	75	Wtg.	F	690
2	75	Wtg.	CW	575
1	60	Al. Ch.	ARY	865
1	50	Wtg.	HF	1180
1	50	G.E.	MT536	1200
1	50	Wtg.	HF	860
1	50	F. M.	HBC	900
1	50	F. M.	HV	720
1	50	Wtg.	CW	690
1	50	Al Ch.	ARY	690
1	5	G.E.	IM	585
1	5	G.E.	MT552	600
1	50	G.E.	MTG	565
1	50	Wtg.	CW865	570
1	40	Wagner	22BR	1725
1	40	Wtg.	CW	1160
1	40	Wtg.	HF	690
1	30	G.E.	MT	1150
1	30	Wtg.	CW	865
1	30	Wagner	BR	850
1	30	Wtg.	HF	860
1	25	G.E.	IM	1730
1	30	G.E.	MT	565
1	25	Century	SR	1170
1	25	Wagner	VBR	860
1	25	Wtg.	CW	1160
1	25	G.E.	MT	570
1	20	G.E.	IM	1800
1	20	G.E.	MT	1710
1	15	Wesche		1200
1	20	G.E.	IM	1140
1	20	Al. Ch.	ARY	1140
1	20	Wagner	BM	720
1	10	G.E.	MT	860
1	10	G.E.	IM	600

VARIABLE SPEED MOTORS

230 Volt D. C.

HP	Make	Type	Speed
1½	Cr. Ch.	CM	925/1210
2	G.E.	RC4	600/1000
3	Gen. Elec.	CD	1050/1700
4	Sprague	C	800/1400
5	Burke	AM12	500/1500
5	Burke	Wam 12	960/1950
7½	Reliance	46T	875/1200
12½	G.E.	C	700/1400
20	G.E.	RF12	500/1500
20	G.E.	RLC	500/1500
20	G.E.	RC11	500/1500
25	G.E.	DLC	500/1000
35	Wtg.	SK140	500/1500
40	G.E.	LC	825/2000
40	Chandysyn.		250/1500
50	Gen. Elec.	RC14	500/1500
50	G.E. Sprague		575/1000
50	Westinghouse	SK	500/1000
60	Electro Dyn.		450/900
90	Westinghouse	SK	575/1150
35/100	G.E.	CD165	425/850
100	Gen. Elec.	CD147	450/1150
100	Gen. Elec.		1100/1800

ROTARY

500 KW syn. rotary converter, 250/275 volts DC, with transfs. & switchgear.

VERTICAL A. C. MOTORS

HP	Make	Type	Volts	Speed
60	Wtg.	CS	2200	1800
100	Wtg.	CW	2300	1160
10	G.E.	KT	220	1800
5	Wtg.	CS	220	850
7½	F.M.	bb	220	3600
7½	G.E.	KT	220	1150

A. C. GENERATORS

KVA	Make	Volts	Speed
60	F. Morse	2200	300
175	Westg.	2200	900
200	G.E.	240	720
200	Westg.	2400	600
210	G.E.	2300	200

SQUIRREL CAGE

2	75	G.E.	KT	2300	900
2	75	G.E.	KT		780
1	75	UG.	CCL		600
1	75	Wtg.	2200	CS	600
1	75	Al. Ch.		AN	680
5	75	G.E.			600
2	100	Al. Ch. 2200 v.			1800
3	100	Westg., 2200/220/440		CS	1200
1	100	West. El.		KT	900
1	100	G.E., 2200 v.		IK	900
1	100	Al. Ch., 2200 v.			450
2	125	G.E, 2200 v.		KT547	1800
1	125	G.E.		K	1800
4	125	G.E.		KT	720
1	150	Westg., 2200 v.		CS	1716
1	150	Al. Ch.			1200
1	150	G.E.		K-558	900
1	150	Westg., 2200 v.		CS	1800
2	150	G.E.		I-K	780
1	150	G.E.		I-K	600
2	150	Westg.		CCL	495
1	200	Westg.		CS	3600
3	200	F. Morse, B.B.			1800
1	200	G.E., 2200 v.		KT	1800
1	200	G.E.		IK	1200
1	200	G.E.			600
1	200	Westg.		CS	600
1	225	G.E., 4160 v.		FT	3600
1	225	G.E., 2200 v.		I-E	1800
4	250	Fair. M.B.B., 2200 v.			1800
1	250	Ideal		A	1200
1	250	F. Morse B.B.		3-brg.	900
2	400	G.E., 2200 v.		I-K	1800
1	700	G.E., 2200, drip-proof constr.		KF	1800

Send for a new bulletin, just off the press, showing our complete stock.

CHICAGO ELECTRIC CO. 1320 W. CERMAK RD. CANAL 2900 CHICAGO 8, ILL.

POWER PLANT EQUIPMENT CO., Inc.

39 Cortlandt Street
New York, N. Y.

A C TURBINE UNITS

6250 KVA G.E., 2300 V., cond.
4000 KVA Al. Chal. 2300 V. cond.
3750 KVA G.E., 2300 V. cond.
3125 KVA G.E., 4100/2300 V. cond.
2500 KVA G.E., 2300 V. cond.
2500 KVA Al. Chal. 440 V. cond.
1250 KVA (2) G.E., 2300 V. cond.
940 KVA Wghse. 6600 V. cond.
937 KVA G.E., auto BLEEDER, 2300 V.
937 KVA G.E., 2300 V. cond.
937 KVA Al. Chal. 2300 V. 300#.
780 KVA Al. Chal. 2300 V. cond.
625 KVA Wghse. 2300 V. cond.
375 KVA G.E., 2300 V. cond.
312 KVA Elliott 480 v. cond.
250 KVA Al. Chal. 480 V. Auto BLEEDER.
150 KVA Wghse. 240 V. cond. (Non Cond.)
375 KVA G.E., 2300 V.
312 KVA C.W.—Moore, 450#, 240 V.
175 KVA Al. Chal.—Sturtevant 220 V.
75 KVA Al. Chal. 240 V.

BOILERS

749 HP (2) Edgemoor, 200#
728 HP Erie City, Ver. 200#
600 HP Connelly, 200#
522 HP Kidwell 207#, 3 drum
471 HP Erie City Ver., 160#
396 HP B. & W., 160#
259 HP (3) Wicks ver.; 160# pulverizers.
250 HP Sterling, 160#
200 HP (2) Scotch Marine, 15#
Two 78" x 18' HRT 125# pulverizers.
850 HP Babcock & Wilcox W. T. Boiler 250# with Riley Stoker.

DIESEL ENGINE SETS

500 KVA Wghse.—Busch Sulzer
375 KVA Wghse.—Busch Sulzer
312 KVA G. E.—Anderson
312 KVA G. E.—McIntosh Sey.
200 KVA G. E.—Busch Sulzer
170 KVA F. M.—F. M. "VA"
140 KVA E. M.—Fairbanks Morse "V"
100 KVA C. W. Bessemer
90 KVA (4) F. M.—F. M. "VA"
75 KVA Al. Chal.—International

BELTED

240 HP Fairbanks 35-E 6 cyl.
225 HP Chicago pneumatic 6 cyl.
80 HP (3) Fairbanks Style V. A.

GAS UNIT

44 KVA Caterpillar, 3-60-220 V.

SPECIAL

937 KVA G.E., 3-60-2300 V.; Surface Condenser, S.B., etc.
780 KVA Al. Chal. 3-60-2300 V.; Surface Condenser, etc.
259 HP (3) Wicks ver. 160#, pulverizers, coal handling equipment.

STEAM ENGINE SETS (A C)

500 KVA (2) G.E.—24 x 48 Bates Corliss
490 KVA Wghse.—Hamilton Cross Comp.
420 KVA Wghse.—Erie Ball Cross comp.
375 KVA G.E.—22 x 27 Erie Ball, 4 V.
210 KVA G.E.—19 x 20 Skinner Unif.
150 KVA G.E.—16 x 15 Skinner Unif.
150 KVA G.E.—16 x 16 Skinner S. V.
125 KVA G.E.—12 x 21 Hamilton 4 V.
100 KVA G.E.—14 x 15 Skinner Unit.

PUMPS (MOTOR DRIVEN)

7500 GPM 80' head
4000 GPM 70' head
3600 GPM 85' head
3250 GPM 425' head
3000 GPM 100' head
3000 GPM (2) 65' head
1390 GPM 231' head
850 GPM 243' head
750 GPM Hill 231' head
350 GPM 720' head

STEAM ENGINE SETS (D C)

450 KW C. W. 250 V.—Nordberg Unif.
300 KW G.E.—Skinner Unif.
150 KW G.E.—Erie Ball 4 V.
100 KW G.E.—Erie Ball 4 V.

AIR COMPRESSORS

2200 CFM Nordberg 100#, Steam and Motor Driven
1080 CFM Nordberg 85#—Motor
500 CFM Ingersoll 100#—Motor
"Steam and Gas Driven"; all sizes

TRANSFORMERS

687 KVA (2) Maloney 13800-460 V.
500 KVA (3) Al. Chal. 33000-440 V.
500 KVA (2) G.E. 6600-2300 V.
500 KVA (2) G.E. 11900/6900-230/460
250 KVA (2) G.E. 6600-2300 V.
150 KVA (2) Furnace Type 6600-90
150 KVA (5) G.E. 2300-120/240
100 KVA (3) G.E. 13200-2300
100 KVA (3) Al. Chal. 22000-440 V.
100 KVA (2) G.E. 13200/6600-440/600 V. & small sizes.
3 Ph. Transformers
750 KVA Wagner 6600-2200 V.
500 KVA (4) G.E. 13200-120/208 V.
500 KVA (2) G.E. 13200-120/208 V.

BOILERS

1—528 HP **Heine**, 350 lb. with underfeed-stoker.
1—335 HP **B & W Sectional Header Boilers**, 200# pressure with superheaters, hand fired grates.
1—250 HP **Casey-Hedges**, 160 lb. pressure.
1—400 HP **Wickes** 3 drum low head boiler, 200# pressure with Chicago Spreader stoker. Installed 1932.
1—90,000# per hr. **Badenhausen Boiler**, 354# pressure.
1—357 HP **Heine** with Riley Underfeed Stoker.
3—253 HP **Vogt** low head **Boilers**, 225# pressure with oil burners, all auxiliaries. New in 1937.
2—300 HP **Heine** 175# pressure.
2—250 HP **Wickes vertical boilers**, powdered fuel.
6—600 HP 200# pressure **O'Brien** boilers.
1—394 HP **Sterling Boiler** chain grate stoker, 160# pressure.
1—585 HP **Erie City** vertical boiler 185# pressure, Type E stoker.
1—600 HP **Union Iron Works** 250# pressure **Chain Grate Stoker** new in 1936.
1—444 HP **Union Iron Works Boiler**, 225# pressure.
2—500 HP **Edge Moor Boilers** 200# pressure.
1—600 HP **Union Iron Wks**, 250# **pressure boiler**, chain grate stoker. New 1935.
1—624 HP **Edgemoor Boiler**, 200# pressure, underfeed stoker.
1—522 HP **Sterling Boiler**, 200# pressure with **Firite Stoker.**
1—640 HP **Heine Boiler**, 199# pressure.
1—484 HP **Springfield Boiler**, 250# pressure oil burners.
2—309 HP **Heine Marine boilers**, 225# pressure.
2—350 HP **Stirling** boilers with auxiliaries.
1—250 HP **Heine** boiler, underfeed stoker.
8—150 HP **HRT Boilers**, 150# pressure.
1—175 HP **Water Tube Boiler**, 160# pressure.
4—1010 HP **Heine** watertube boilers 250# pressure.
1—400 HP **Connolly Boiler** 160# pressure with new tubes and auxiliaries.
4—72" x 18' **HRT** boilers including a 637 KVA General Electric condensing turbine. Complete plant.
1—150 HP **HRT**, 125# pressure, rebuilt and guaranteed.
56—50 HP **Vertical Boilers** 150# pressure all auxiliaries.

TURBINES

2—5000 KW **Westinghouse** 1800 RPM 3-60-2300 volts **Surface Condenser**, all auxiliaries.
1—3200 KW **Allis-Chalmers Condensing Turbine** with auxiliaries.
1—2500 KW **General Electric Condensing Turbine**, with auxiliaries.
15,000 KVA **Westinghouse** turbine, condenser.
1—1000 KW **Westinghouse non-condensing turbines** 350# pressure, 16# back pres.
1—937 KVA **Allis-Chalmers Turbine.**
1—625 KVA **General Electric Turbine** with jet condenser.
1—2000 KW **Westinghouse Turbine** with Surface Condenser and auxiliaries 3-60-440 volts.
1—300 HP **Kerr** Non-condensing 3600 RPM volts.
1—250 KVA **Waite Turbine** either condensing or non-condensing.
1—250 KVA **General Electric non-condensing Turbine.**
1— 125 KW **General Electric non-condensing Turbine.**

ENGINE GENERATOR SETS

1—340 KVA **Skinner** Uniflow Engine Generator set with panel board.
2—200 KW 250 volt D.C. **engine generator sets.**
1—250 KVA **Ridgeway** engine generator set.
1—500 KVA **Allis-Chalmers** Corliss.
17 inch by 18 inch **Skinner** uniflow engine.
1—166 KVA **Ames Uniflow engine generator set.**
1—260 KVA **Skinner** uniflow engine.
2—625 KVA **Bates Corliss** engines.
1—7 ft. diameter by 175 ft. self supporting stack.

DIESEL ENGINES

2—200 KVA **Fairbanks-Morse** Full Diesel **Engine Generator.**
1000 KVA **Diesel** Generator Plant complete.
1—**Busch Sulzer** Full Diesel direct connected 1335 KW AC **generator,** rebuilt and guaranteed.
1,250 KVA **Nelesco** engine generator.

ENGINE GENERATOR SETS

1—625 KVA **Nordberg** Uniflow engine.
400 KW **Skinner** Uniflow **Engine Generator set.**

MISCELLANEOUS

54,000 pound **Cochrane** hot process lime and water softener.
2500 HP **Cochrane** Open Feed Water Heater.
1—10' x 15' **Illinois** Forced Draft Chain Grate Stoker.
2—6 **Retort Taylor Stokers.** First-class condition.
1—8 retort **Taylor,** brand new stoker.
1—800 HP **Hoppes** open feedwater heater.

SEE *Fletcher* FIRST!

FLETCHER SALES CO.

325 Fincastle Building — LOUISVILLE, KY.

SLIP RING MOTORS

3-HP., 60-CY

HP	Volts	Make	Speed
900	2200	G.E.	900
500	2300	Whse	514
450	2300	G.E.	600
400	2300	Whse.	1200
350	220–440	G.E.	1800
300	2200	G.E.	1800
300	2200	Whse.	514
250	2300	G.E.	600
250	440–550	G.E.	600
200	2200–550	G.E.	1800
200	2200–400	G.E.	600
150	440–220	G.E.	1800
150	440	G.E.	1800
150	550–2200	G.E.	1800
150	550	G.E.	720
125	440–220	G.E.	600
100	550–2200	G.E.	720
100	440–220	G.E.	1800
100	220–440	G.E.	720
100	220–440	G.E.	900
75	220–440	G.E.	900

SYNCHRONOUS MOTORS

3-PH., 60-CY.

600	2200	Whse.	900
350	440–220	G.E.	900
300	440–220	Al. Ch.	600
200	2300–4000	G.E.	1200
110	440	Whse.	900
100	2200–550	Al. Chal.	1800
75	440–220	G.E.	720

PUMP

1—8" Dredge Pump 1880 GPM, 120' Morris Machine Works with direct connected Slip Ring Motor 125 HP, 600 RPM, G.E.

OUTDOOR OIL CIRCUIT BREAKER

1—New 400 Amp. Type FK, 136-1328A, General Elec. 3PST, 25,000 Volt Oil Switch, Interrupting Capacity 125,000 KVA, complete CT's PT's, etc.
1—3000 ampere, type FK 25, General Electric, 3 pst, 600 volt

TRANSFORMERS

60 CYCLE

3—500 kva., G.E., type H, form KS, 13800-230/460
3—500 kva., Whse., 22000-2300.
3—350 kva., G.E., type H-KD 13200-4600.
3—333 kva., G.E., type H-KDD 2400-460/230
3—250 kva., Whse., 13,800-460.
3—200 kva., G.E., type H 10000-600.
3—200 kva., G.E., H-KD 6600-2300/4000Y., 25 cy.
3—175 kva., G.E., 4000-480.
3—150 kva., G.E., type H-KDD 13200-2300.
3—150 kva., Al. Chal., type OISC 10400-2400.
1—100 kva., Pittsburgh, type OISC 2400-240-120.
3—100 kva., G.E., type H 2400-240-480.
3—100 kva., G.E., type H-KDD, 6900/11950Y-230/115.
3—100 kva., Whse., 22,000-2300.
2— 75 kva., G.E., type HK, 2300-230/115.
3— 50 kva., Moloney, 2300-230/115.
6— 50 kva., Whse., type SK, 13800-240/120.
3— 50 kva., Whse., 22,000-2300.

SQUIRREL CAGE MOTORS

HP	Volts	Make	Type	Speed
500	440/220	G.E.	IK	1200
550	440/220	G.E.	IK	900
400	440	G.E.	KTP	1200
400	2200	Whse.	C.S.	1800
300	2200	G.E.	IE-K	1800
250	2200	G.E.	IK	600
250	2200	Whse.	CS	1200
250	440/220	G.E.	IK	1800
200	220/440	G.E.	IK	720
150	2200	Allis Ch.	AN	450
150	440/220	Whse.	CS	514
125	440/220	G.E.	KT	1800
100	2200	G.E.	IK	600
100	2200	G.E.	IE-K	1800
100	550	G.E.	KT	900
100	220/440	G.E.	KT	720
75	2200	G.E.	KT	900
75	2300	G.E.	IE-K	1800
60	550	G.E.	FT	3600
50	220/400	G.E.	K	1800

MOTOR GENERATOR SETS

2—150 kw, 125 v., 1200 rpm, Whse., conn. to 220 hp, 440/220 v., 3 ph., 60 cy., syn, very modern, practically new.
75 KW, 125 V. 1200 RPM Westinghouse Conn. to 112 H.P. 2300/440 V. 3 ph. 60 cy. Ind. motor.
1—75 KW 250 V. 1800 RPM, Cr. Wh., Type CCD con. to 100 H.P., 2200 V., 3 ph., 60 cy. syn.

A.C. GENERATORS

1—500 kva., 900 r.p.m., 2209 V. Whse. Condenser.
1—300 kva., 900 r.p.m., 240/480 V., G.E.
1—225 kva., 600 r.p.m., 2200-240 V., G.E.
1—110 kva., 900 r.p.m., 440 V., G.E.
1— 60 kva., 720 r.p.m., 240/480 V., G.E.
1— 25 kva., 3600 r.p.m., 220 V., G.E.

STEPHEN HALL & CO.

HARRY J. RICE PRES.

458 SEVENTH ST. HOBOKEN, N. J.

POWER PLANT EQUIPMENT

Turbo-Generators

1—4000 KW GE Cond. 2300 V.
1—3000 KW GE Cond. 600 V.
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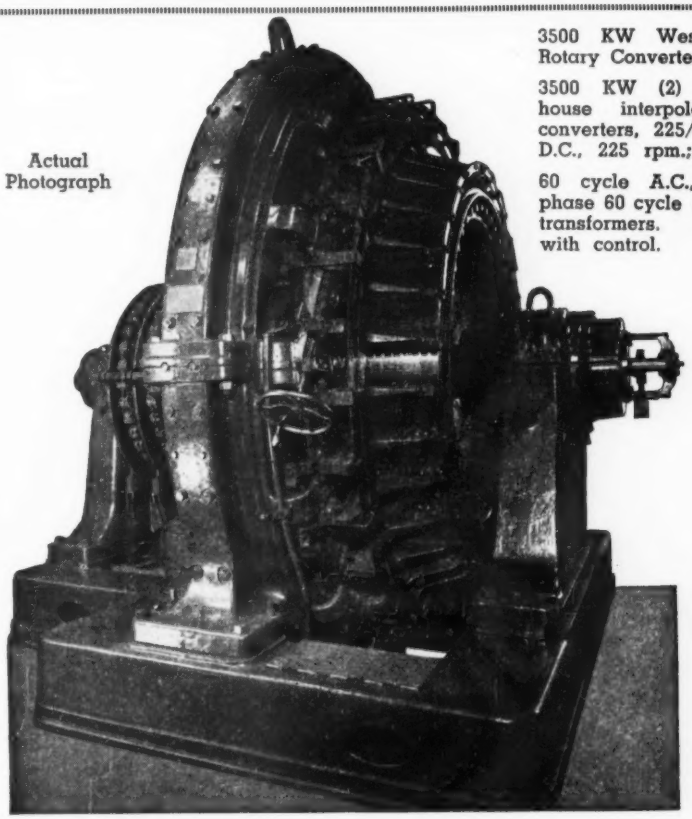

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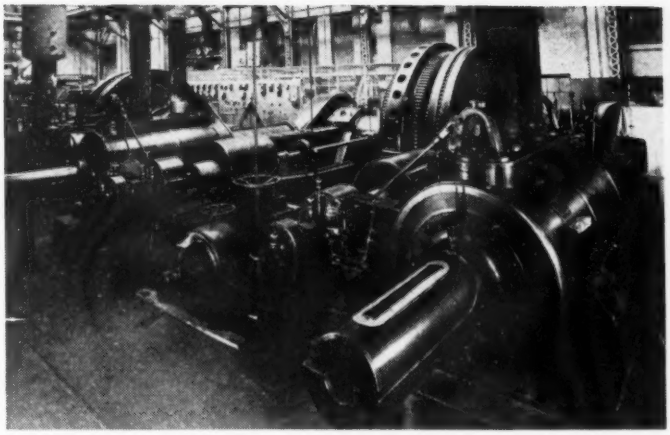

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DENNY & CLARK, 910 N. Marshfield Ave., Chicago 22, Ill.

2—2000 KW G.E. **ROTARY CONVERTORS,** HCC, 250/300 Volts, D.C. booster type. Each complete throughout. Transformers 4600/2300 v. 3/60.

1—3000 KVA **SYNCH. CONDENSER,** 3/60/2200. 900 RPM. With Transformers, 1/60-40000/22000/19800 to 2200 volts. Complete. Can see running.

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30 Church St. New York, 7, N. Y.

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STEAM ENGINES

(with or without generators)

H.P.	Make	Cyl. Size	Flywheel	K.V.A.
750	Corliss	32x42	20'	
600	Corliss	24x36	17'	
600	Robb-Armstrong	21x39x24		500
	Robb-Armstrong	21x36x24		360
275	Twin City	16x42	14'	220
250	McEwen	12x16	6'	200
	Robb-Armstrong	12x18x14	6'	120
	Robb-Armstrong	11x17/14	6'	100

DIESELS

H.P.	Make	R.P.M.	K.V.A.
675	2—Campbell	225	520
400	2—Dominion Crossley	514	375
350	1—Kromhout	240	250
550	1—Electric Boat	225	
120	1—Polar Atlas	275	100
100	1—FM CO 2	450	75

HYDRO PLANTS

K.V.A.	Head	R.P.M.
450	600 ft.	
665	500 ft.	450
2—450	60 ft.	

Motor Generators or Convertors

KVA	Volts	Cycle	Phase	dc	RPM
435	4000	60	3	600	870
435	4000	60	3	600	870
180	2200	60	2	125	580
436	13200	60	3	600	720
550	13000	60	3	600	720
					375
1500	12200	25	3	275	485
1500	12000	25	3	275	485
1287	12000	25 to 60 cycle			

Synchronous Motors or Condenser

125	2200	60	3	110	245
500	574	25	3	60	750
750	2200	60	3	100	
500	2300	60	3	20 pole	360
5000	13200	25	3		300

COMPRESSORS

Make	Size	Cap.	Type	Motor
Ing.-Rand	11¼x7x8	444	VH	Syn. or S. C
Gard.Den.	19x9x12			
Can.Rand	10 x14	150	Steam	
Can. Ing. Rand	19½x12x10	1000	VHE	Synchronous
Holman	6¾x7	160		S. C.
Ing. Rand	7x7	100	ESI	S. C.
Ing. Rand	22x12x12	1790	SVHE	Synchronous
Ing. Rand	25x15¼x18	1708	PRB	Synchronous

CRUSHER

Allis Chalmers	21 K	
Allis Chalmers	No. 5	30 ton hour
McCully	No. 9	160 ton hour

STEAM TURBINES

Kva or Kw	AC or DC	Volts	Make
50	DC	110	Westinghouse
200	DC	115–230	Goldie McCullock
500	DC	440	Hariand Generator
50	AC	440	Westinghouse
75	AC	440	Westinghouse
200	AC	2200	General Electric
2—500	AC	2200	General Electric
1000	AC	480	Allis Chalmers
1000	AC	480	Curtiss
1500	AC	2200	Siemons
2—3750	AC	2200	General Electric

GENERATORS

Kw	Volts	RPM	Cycle
1500	2300	200	60
2 only 500	440	750	DC
937½	550	375	60
500	2300	360	60
200	550	600	60
115	2200	257	60

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MODERN
3/60/2300

WANTED
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DIESEL
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Warren, Ohio
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URGENTLY NEEDED
(for re-sale on bona-fide inquiries)
2—500 HP and 2—400 HP B&W or good make str. tube ASME boilers with or without firing equipment.
2—125/150/200 or 250 HP Scotch or Economic ASME Boilers.
1—5000 KW Diesel Generating Set composed of one or several units to total 1000 KW. 3/60/2300.
1—1000 KW Diesel Generating Unit.
Give price, specifications, location
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507-5th Ave. New York (17)
Murray Hill 2-5740-41

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COMPLETE POWER PLANT
For cash immediately a complete 1400 to 2000 K.W. A.C. Steam Turbine Power generating plant. Stoker fired, water tube boilers, single or multiple turbine units, full or surface condensing type, preferred. Desire plant now fully assembled and equipped with auxiliaries, exciter, condenser, feed pumps, heaters, piping and switchboard.

Write giving full information. Address

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520 North Michigan Ave., Chicago 11, Ill.

WANTED
Open type feed water heater 500 H.P. Closed coil type low press. water heaters various sizes. Recording thermometers to 240 deg. F. Steam press. recording ga. to 120 PSI. Glass or dial type thermometers to 300 deg. F.
W-697, Power
330 West 42nd St., New York 18, N. Y.

WANTED
1—AC Single-Phase Belt-driven Generator with Base and Exciter, 25 or 30 KVA, 125 volts, 60 cycles 900 or 1200 R.P.M. with complete control-panel
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New "SEARCHLIGHT" Advertisements
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Address copy to the Departmental Staff
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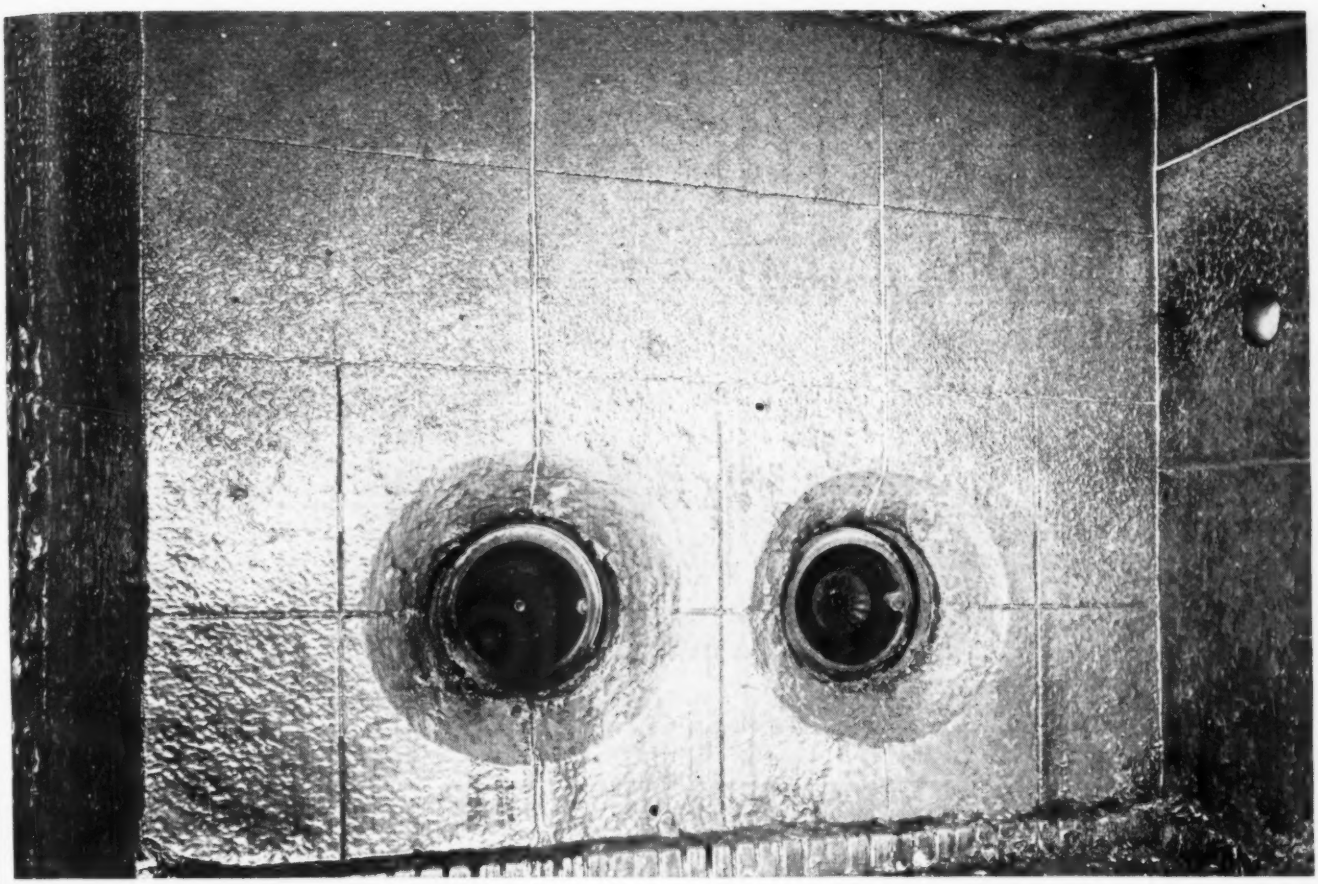

Do your furnace linings look like this?

The above photograph shows a representative Plibrico furnace lining which is standing up well in severe service. It is the kind of lining you, yourself, can expect if you use Plibrico Jointless Firebrick for your boiler furnaces.

This Plibrico installation is in connection with an oil-fired Foster Wheeler steam generator, 18,000 lbs. steam per hr., 375 lbs. pressure. Clearly, there is not a weak spot in the entire lining. The thousands of vulnerable joints found in ordinary laid-up fire brick have been eliminated. There is no sign of bulging.

Glance over the list of Plibrico features at the right, and you'll understand why Plibrico Jointless Firebrick is so satisfactory. Since Plibrico is installed in moist, plastic form and can be moulded to any shape or contour, it eliminates special tile shapes so is especially suitable for front walls, door and burner openings, arches, etc.

Plibrico refractory products and installation service are available through distributors in over 100 cities in the U. S. and Canada, or your own maintenance men can install these convenient refractories. For further information, write for complete catalogs and prices, specifying whether you wish literature on H.R.T. or water tube boilers.

PLIBRICO JOINTLESS FIREBRICK COMPANY
1818 Kingsbury Street, *Dept. F.*, Chicago 14, Illinois

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- **Air Tight**—No infiltration to cut combustion efficiency.
- **Securely Anchored**—Patented Flexo-Anchors; free movement with expansion, contraction.
- **Easily Installed**—Just pound it into place.
- **Economical**—Lower labor cost; no special tile shapes.
- **Durable**—Outlasts laid-up fire brick.
- **Versatile**—Patching, repairs, or complete linings.
- **Adaptable** — Air-cooled and sectionally-supported where desirable.
- **Available**—100 local stocks in U. S. and Canada.
- **Service**—Engineering and installation if desired.

PLIBRICO *Jointless* **FIREBRICK**

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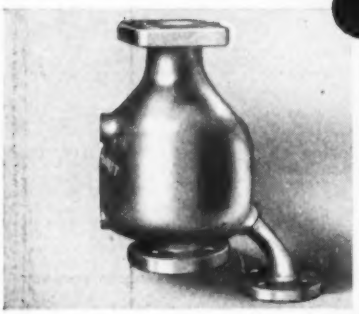

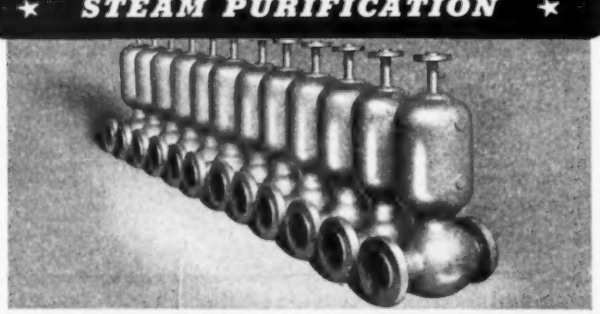

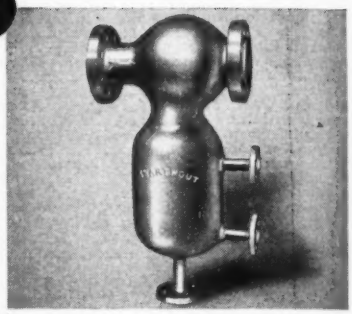

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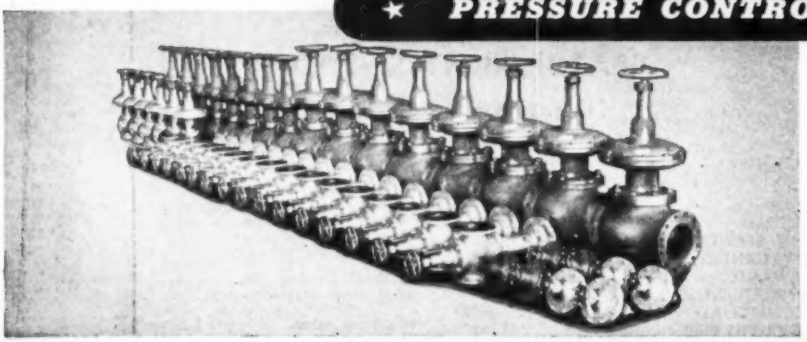

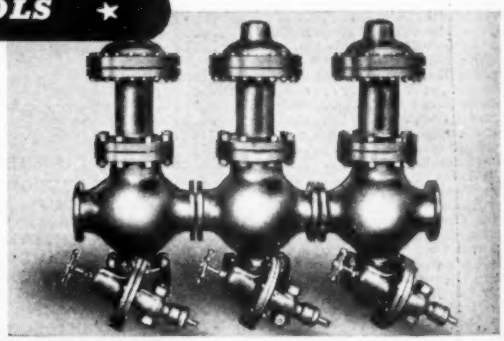

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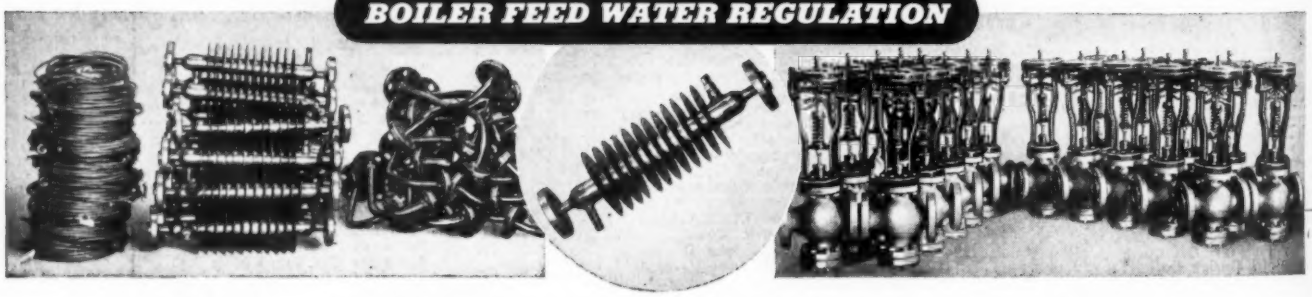

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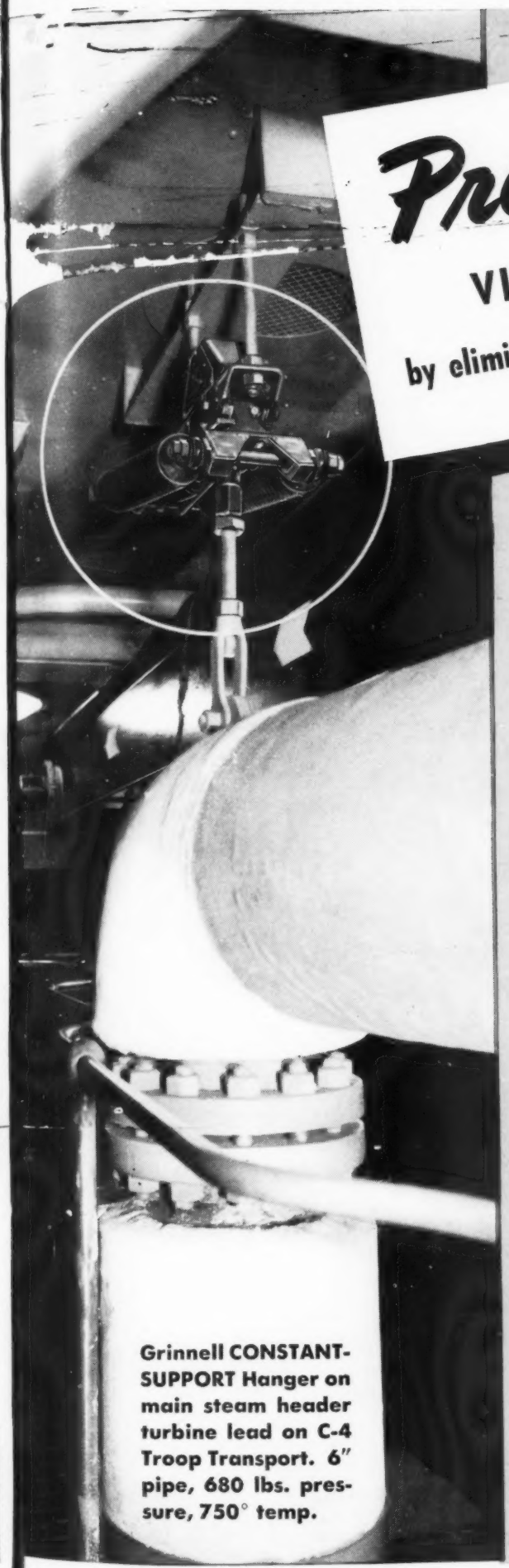

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